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U.S. Department of Energy
Idaho Operations Office

Injection Well Field Sampling Plan for the Phase I Operable Unit 3-14 Remedial Investigation/Feasibility Study

INEEL
IDAHO NATIONAL ENGINEERING & ENVIRONMENTAL LABORATORY

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ABSTRACT

This Field Sampling Plan supports the Operable Unit 3-14 remedial investigation of the Idaho Nuclear Technology and Engineering Center (INTEC) injection well and aquifer beneath the perimeter of INTEC fence line. The number of the INTEC injection well is MAH-FE-PL-304. Historically, the name was shortened to CPP-03; in this document the well will be referred to as the INTEC injection well (CPP-23).

Activities described in this Field Sampling Plan include coring, drilling, and sampling of the INTEC injection well and the coring and installation of two additional aquifer monitoring wells. In addition to drilling and sampling activities, this Field Sampling Plan also addresses sampling analytes, procedures, equipment, designation, and quality assurance/quality control protocols.

The aquifer monitoring wells are intended to characterize contamination to the Snake River Plain Aquifer adjacent to and downgradient from the injection well. Because final specifications of the two monitoring wells, including total well depth and sampling locations, are dependent on drilling and coring results at the injection well, sampling details described herein (e.g., sample depth and frequency) may be modified and described in the Well Completion Report.

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FIGURES

TABLES

ACRONYMS

ALARA	as low as reasonably achievable
ARDC	Administrative Records and Document Control
ASTM	American Standards for Testing and Materials
BBWI	Bechtel BWXT Idaho, LLC
bgs	below ground surface
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
COC	chain of custody
CTR	Contractor Technical Representative
DAR	document action request
DOE	U.S. Department of Energy
DOE-ID	U.S. Department of Energy, Idaho Operations Office
DOT	U.S. Department of Transportation
DQOs	data quality objectives
ECA	environmentally controlled area
EPA	U.S. Environmental Protection Agency
ER	Environmental Restoration
ES&H	environmental safety and health
ES&H/QA	Environmental Safety and Health/Quality Assurance
FCC	Field Construction Coordinator
FFA/CO	Federal Facility Agreement and Consent Order
FS	feasibility study
FSP	Field Sampling Plan
FTL	Field Team Leader
HASP	health and safety plan
HDPE	high-density polyethylene

HEPA	high efficiency particulate air
HSO	health and safety officer
ICPP	Idaho Chemical Processing Plant
ID	identification
IDEQ	Idaho Department of Environmental Quality
IDW	investigation-derived waste
IH	Industrial Hygienist
INEEL	Idaho National Engineering and Environmental Laboratory
INTEC	Idaho Nuclear Technology and Engineering Center
ISMS	Integrated Safety Management System
JRC	job requirements checklist
JSS	Job Site Supervisor
MCP	Management Control Procedure
NEPA	National Environmental Policy Act
NPL	National Priorities List
OMP	Occupational Medical Program
OSHA	Occupational Safety and Health Administration
OU	operable unit
PCB	polychlorinated biphenyl
PLN	plan
PM	project manager
PPE	personal protective equipment
PRD	program requirements directives
PVC	polyvinyl chloride
QA	quality assurance
QC	quality control

QAPjP	Quality Assurance Project Plan
RadCon	radiological control
RCT	Radiological Control Technician
RI	remedial investigation
RI/FS	remedial investigation/feasibility study
ROD	Record of Decision
SAD	Site Area Director
SAP	sampling and analysis plan
SMO	Sample Management Office
SNF	spent nuclear fuel
SOP	standard operating procedure
SOW	Statement of Work
SRPA	Snake River Plain Aquifer
SVOC	semivolatile organic compound
TOS	Task Order Statement of Work
TPR	technical procedure
USGS	U.S. Geological Survey
VOC	volatile organic compound
VPP	Voluntary Protection Program
WAG	Waste Area Group

Injection Well Field Sampling Plan for the Phase I Operable Unit 3-14 Remedial Investigation/Feasibility Study

1. INTRODUCTION

This Waste Area Group (WAG) 3, Operable Unit (OU) 3-14, Field Sampling Plan (FSP) describes the field sampling activities that will be performed for the OU 3-14 remedial investigation (RI) phase of the remedial investigation/feasibility study (RI/FS) of the Idaho Nuclear Technology and Engineering Center (INTEC) injection well and the immediate area (Site CPP-23) and that portion of the aquifer underlying the perimeter of the INTEC fence line. This FSP provides the details, processes, and programs that will be used to ensure that the data generated are suitable for their intended uses.

In accordance with the Federal Facility Agreement and Consent Order (FFA/CO) (DOE-ID 1991), this FSP is the first of a two-part sampling and analysis plan (SAP). The second part of the SAP, the *Quality Assurance Project Plan (QAPjP) for WAGs 1, 2, 3, 4, 5, 6, 7, 10, and Inactive Sites* (DOE-ID 2000a), is the governing quality assurance project plan. The field sampling activities will also be conducted in accordance with the *Implementing Project Management Plan for the Idaho National Engineering and Environmental Laboratory Remediation Program* (INEEL 1998), which along with the QAPjP establish the quality requirements for Idaho National Engineering and Environmental Laboratory (INEEL) environmental restoration activities. These plans have been prepared pursuant to the National Oil and Hazardous Substances Pollution Contingency Plan (40 CFR 300) and guidance from the U.S. Environmental Protection Agency (EPA) for the preparation of SAPs (EPA 1988).

1.1 Field Sampling Plan

The purpose of this FSP is to guide the collection and analysis of samples from the OU 3-14 Site CPP-23. The investigation at Site CPP-23 includes the following objectives:

- Delineate the horizontal and vertical extent of contamination in the INTEC injection well (CPP-03) and the surrounding aquifer and basalt/interbed matrix.
- Determine whether a source of contamination remains in the INTEC injection well.
- Characterize the nature and presence of the contaminants of concern in the sediment within the INTEC injection well and the aquifer to define the risk to the groundwater pathway. Analytes to be tested are listed in Appendix A.
- Provide site-specific data to support fate and transport modeling for the evaluation of remedial alternatives.
- Provide technical data to support the feasibility study (FS) phase of the OU 3-14 RI/FS.
- Provide sample material to archive for subsequent treatability studies.

1.2 Health and Safety Plan

The Health and Safety Plan (HASP) for the WAG 3, Operable Unit 3-14, injection well (Site CPP-23) drilling and sampling project (INEEL 2000) is the governing HASP for this FSP. The HASP will be amended, as appropriate, through a document action request (DAR) before any field activities begin.

1.3 Project Organization and Responsibility

The organizational structure reflects the personnel whose resources and expertise are required for the work activities discussed in this FSP, concurrently achieving minimization of the risks to worker health and safety. A hierarchical structure (see Figure 1-1) delineates the positions and responsibilities of personnel who will be filling key roles at the work site. The following subsections outline the responsibilities of key personnel.

1.3.1 Environmental Restoration Program Director

The INEEL Environmental Restoration (ER) director has ultimate responsibility for the technical quality of all projects, while maintaining a safe environment and the safety and health of all personnel during field activities performed by or for the ER program. The ER director provides technical coordination and interfaces with the U.S. Department of Energy, Idaho Operations Office (DOE-ID) Environmental Support Office. The ER director is responsible for ensuring that:

- Project and program activities are conducted in accordance with all applicable federal, state, local, and company requirements and agreements
- Program budgets and schedules are approved and monitored for compliance
- Required personnel, equipment, subcontractors, and services are available
- Direction is provided for development of tasks, evaluation of findings, development of conclusions and recommendations, and production of reports.

1.3.2 Waste Area Group 3 Manager

The WAG 3 Manager has overall responsibility for ensuring that the OU 3-14 Project meets the agreements and requirements defined in the OU 3-14 RI/FS Scope of Work and Work Plan. This responsibility includes the overall planning, organizing, directing, measuring, and reporting of project performance. Effective and timely communications with DOE-ID are a pivotal part of this responsibility. The WAG manager has other specific responsibilities that include, but are not limited to, the following items:

- Establishing and maintaining the technical, cost, and schedule baselines for the project, including performance measurement, control, and reporting requirements
- Forecasting and managing funding requirements
- Identifying, characterizing, and coordinating configuration change requirements involving baselines.

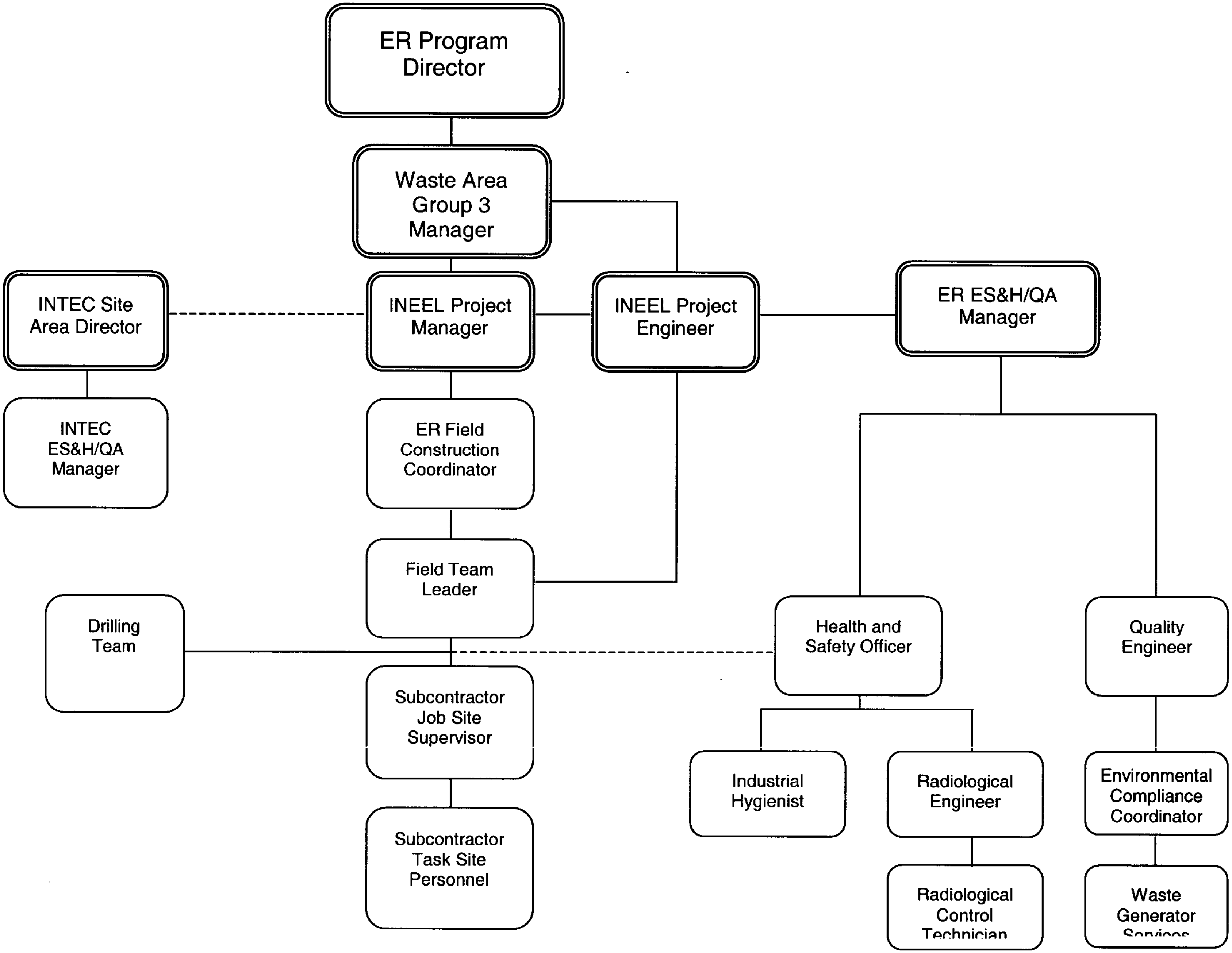

Figure 1-1. Organizational structure for OU 3-14 field sampling activities.

1.3.3 INEEL Project Manager

The INEEL project manager (PM) is responsible to ensure that all activities conducted during the project comply with INTEC Site Director requirements. The requirements are outlined in Management Control Procedure (MCP) -2798, "Maintenance Work Control," and MCP-3003, "Performing Pre-Job Briefings and Post-Job Reviews," other INEEL MCPs and program requirements directives (PRDs), Occupational Safety and Health Administration (OSHA) requirements, and all applicable EPA, U.S. Department of Energy (DOE), U.S. Department of Transportation (DOT), and State of Idaho requirements. The tasks must comply with the *Implementing Project Management Plan for the Idaho National Engineering and Environmental Laboratory Remediation Program* (INEEL 1998), the QAPjP, the project HASP, and this FSP. The PM is also responsible for the overall scope, schedule, and budget of the project. The PM has the following functions and responsibilities:

- Coordinate all document preparation and field, laboratory, and modeling activities
- Ensure that the Enhanced Work Planning process is in compliance
- Ensure that a pre-job briefing and a post-job review are performed
- Implement the FSP requirements
- Ensure that work is performed, as planned, for the project
- Develop resource-loaded, time-phased control account plans based on the project technical requirements, budgets, and schedules
- Assign project tasks
- Ensure technical review and acceptance of all project documentation
- Develop documentation required to support the FSP
- Develop site-specific plans that are required by ER such as work plans, environmental safety and health (ES&H) plans, and SAPs
- Ensure that project activities and deliverables meet schedule and scope requirements as described in the FFA/CO Action Plan (DOE-ID 1991)
- Identify requirements, and follow the schedule for public review and the comment process as set forth in the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) (42 USC § 9601 et seq.)
- Coordinate and interface with the units within the program support organization who provide project support on issues relating to quality assurance (QA), environmental safety and health, and the National Environmental Policy Act (NEPA) (42 USC § 4321 et seq.)
- Coordinate site-specific data collection, review for technical adequacy, and data input to an approved database, such as the Environmental Restoration Information System

- Coordinate and interface with subcontractors to ensure that milestones are met, adequate management support is in place, technical scope is planned and executed appropriately, and project costs are kept within budget.

1.3.4 INTEC Site Area Director

The INTEC Site Area Director (SAD) or designee has the authority and responsibility to ensure proper guidance of all activity within the INTEC for all work processes and work packages including, but not limited to, the following:

- Establish and execute monthly, weekly, and daily operating plans
- Execute the INTEC Environmental Safety and Health/Quality Assurance (ES&H/QA) program
- Execute the Integrated Safety Management System (ISMS) for the INTEC
- Execute the Enhanced Work Planning process for the INTEC
- Execute the Voluntary Protection Program (VPP) at the INTEC
- Oversee the execution of all environmental compliance at the INTEC
- Execute that portion of the voluntary compliance order that pertains to the INTEC.

1.3.5 Environmental Restoration Environmental Safety and Health/Quality Assurance Manager

The Environmental Restoration Environmental Safety and Health/Quality Assurance (ER ES&H/QA) Manager or designee is responsible for ensuring that ES&H oversight is provided for all ER programs and projects. This position reports to and is accountable to the ER Program Director. The ER ES&H/QA manager performs line management review, inspections, and oversight in compliance with INEEL MCP-2727, "Performing Safety Reviews." Project or program management shall bring to the ER ES&H/QA manager or respective compliance officer all ES&H/QA concerns, questions, comments, and disputes that cannot be resolved by the health and safety officer (HSO) or one of the assigned ES&H professionals.

1.3.6 INTEC ES&H/QA Manager

The INTEC Environmental Safety and Health/Quality Assurance (ES&H/QA) manager or designee is responsible for ensuring that ES&H oversight is provided for all ER programs and projects. This position reports to and is accountable to the INTEC site director. The INTEC ES&H/QA manager performs line management review, inspections, and oversight in compliance with INEEL MCP-2727. Project or program management shall bring all ES&H/QA concerns, questions, comments, and disputes that cannot be resolved by the HSO or one of the assigned ES&H professionals to the ER ES&H/QA manager or to the INTEC ES&H/QA manager.

1.3.7 ER Field Construction Coordinator

The Field Construction Coordinator (FCC) is the construction supervisor for the project. The FCC manages field operations, executes the work plan, enforces site control, and is responsible for ensuring that pre-job briefings are conducted in accordance with INEEL MCP-3003, "Performing Pre-Job Briefings and Post-Job Reviews." All safety issues must be brought to the attention of the FCC. The FCC will work with the Field Team Leader, HSO, and radiation control (RADCON) personnel to resolve safety and health issues. This person will provide facility support and coordinate and oversee the contracts (i.e., approve the subcontractor hours).

1.3.8 Field Team Leader

The Field Team Leader (FTL) represents the ER organization at the task site and is responsible for the safe and successful completion of the project. The FTL works with the PM to manage field sampling and related operations and executes the work plan. The FTL enforces task site control, documents the activities, and may conduct the daily safety briefings at the start of a shift. Health and safety issues must be brought to the attention of the FTL.

If the FTL leaves the task site, a designee is appointed as acting FTL. The designated FTL must meet all FTL training requirements as outlined in the project HASP. The identity of the acting FTL is conveyed to task site personnel, recorded in the FTL logbook, and communicated to the INTEC director, or designee.

The FTL complies with the requirements outlined in MCP-3003 by completing the briefings and reviews, and submitting the documentation to the INTEC site director and ER ES&H/QA manager. The FTL also completes the job requirement checklist (JRC) in accordance with STD 101, "Integrated Work Control Process."

The FTL is responsible for compliance with waste management requirements and coordinates such activities with the Environmental Compliance Coordinator or designee.

1.3.9 Health and Safety Officer

The Health and Safety Officer (HSO) works at the task site and serves as the primary contact for health and safety issues. The HSO shall assist the FTL (see Section 1.3.8) and the Industrial Hygienist (IH) (see Section 1.3.10) with all aspects of health and safety, which includes compliance with the Enhanced Work Planning process, and is authorized to stop work at the task site if any operation threatens worker safety or public health. The HSO may be assigned other responsibilities, as stated in other sections of the project HASP, as long as primary responsibilities are maintained. The HSO is authorized to verify compliance to the HASP, conduct inspections, require and monitor corrective actions, monitor decontamination procedures, and require corrections, as appropriate. ES&H professionals at the task site support the HSO. These professionals are the IH, radiological control technician (RCT), radiological engineer, environmental compliance coordinator, and facility representative.

The individual assigned as the HSO, or designee, must be qualified in accordance with the OSHA definition to recognize and evaluate hazards and will be given the authority to ensure worker protection.

The IH duties, or in some cases FTL duties, may also be performed by the HSO. The dual role of the HSO and FTL will depend upon the hazards, complexity, and size of the activity involved at the task site and will require concurrence from the ER ES&H/QA manager. Other pertinent responsibilities of the HSO must not conflict (philosophically or in terms of significant added volume of work) with the role of the HSO at the task site.

If it is necessary for the HSO to leave the task site, an alternate individual will be appointed by the HSO to fulfill this role. The identity of the acting HSO will be recorded in the FTL logbook, and task site personnel will be notified.

1.3.10 Industrial Hygienist

The assigned Industrial Hygienist (IH) is the primary source for information about non-radiological hazardous and toxic agents at the task site. The IH assists the FTL in completing the JRC and assesses the potential for worker exposures to hazardous agents in accordance with the INEEL *Safety and Health Manual* (INEEL 1997), MCPs, and accepted industry IH practices and protocol. By participating in task-site characterization, the IH assesses and recommends appropriate hazard controls for the protection of task site personnel, operates and maintains airborne sampling and monitoring equipment, recommends and assesses personal protective equipment (PPE) required in the project HASP, and may recommend changes as appropriate.

If an evacuation becomes necessary, the IH, in conjunction with the recovery team, assists the FTL in determining whether conditions exist for safe task site reentry as described in the project HASP. Personnel showing health effects (i.e., signs and symptoms) resulting from possible exposure to hazardous agents will be referred to an Occupational Medical Program (OMP) physician by the IH, their supervisor, or the HSO. The IH may have other duties at the task site, as specified in the project HASP, or in pertinent INEEL PRDs or MCPs. During emergencies involving hazardous materials, the subsequent airborne sampling and monitoring results will be coordinated with the INEEL Emergency Response Organization.

1.3.11 Radiological Engineer

The radiological engineer is the primary source for information and guidance relative to the evaluation and control of radioactive hazards at the task site. If a radiological hazard exists or occurs at the task site, the radiological engineer makes recommendations to minimize health and safety risks to task site personnel. Responsibilities of the radiological engineer include the following:

- Perform radiation exposure estimates and as low as reasonably achievable (ALARA) evaluations
- Recommend pertinent radiological monitoring equipment necessary for the work
- Advise the FTL and RCT of changes in monitoring or PPE
- Apprise personnel of task site evacuation and reentry.

The radiological engineer may have to perform evaluations that are specified in MCP-425, "Radiological Release Surveys and the Disposition of Contaminated Materials," for release of materials with inaccessible surfaces. The radiological engineer also may have other duties to perform as specified in the project HASP or in the INEEL Radiation Protection Manual (PRD-183).

1.3.12 Radiological Control Technician

The radiological control technician (RCT) is the primary source for information and guidance on radiological hazards. During work operations when a radiological hazard to personnel may exist or is anticipated, the RCT is present at the task site. The RCT assists the FTL in completing the JRC. Responsibilities of the RCT include performing a radiological survey of the task site with the necessary equipment and obtaining samples for radiological analysis, providing guidance for radioactive decontamination of equipment and personnel, and accompanying the affected personnel to the nearest INEEL medical facility for evaluation if significant radiological contamination occurs. The RCT must notify the FTL of any radiological occurrence that must be reported as directed by the INEEL Radiation Protection Manual (INEEL). The RCT may have other duties at the task site as specified in the project HASP or in INEEL PRDs or MCPs.

1.3.13 Drilling Team

The drilling team will perform all tasks associated with drilling, coring, and completing these wells. They will report to the Subcontractor Job Site Supervisor. They will be responsible for drilling, coring, and well construction per the Statement of Work (SOW) for drilling the abandoned INTEC injection well. They will assist the sampling team in all activities associated with collection of drill cuttings or core for sampling and archival purposes.

1.3.14 Subcontractor Job Site Supervisor

The subcontractor Job Site Supervisor (JSS) supervises subcontractor personnel at the task site and may also serve as the subcontractor PM. A subcontractor JSS is the subcontractor safety representative at the task site. The subcontractor JSS and FTL work as a team to accomplish day-to-day operations at the task site, identify and obtain additional resources needed at the task site, and interact with the HSO, IH, radiological engineer, and RCT about health and safety matters. The subcontractor JSS, like the FTL, must be informed about any health and safety issues that arise and may stop work at the task site if an unsafe condition exists. The subcontractor JSS will provide information to the FTL about the nature of their work for input at the daily pre-job briefing.

1.3.15 Subcontractor Task Site Personnel

All task site personnel, including the INEEL contractor and subcontractors, must understand and comply with the requirements of the project HASP. The FTL or task site JSS briefs personnel at the start of each shift. During the pre-job briefing, all daily tasks, associated hazards, engineering and administrative controls, required PPE, work control documents, and emergency conditions and actions are discussed. Input is provided from the project HSO, IH, and RCT personnel to clarify task health and safety requirements. All personnel are encouraged to ask questions about site tasks and provide suggestions on ways to perform required tasks in a safer and more effective manner based on the lessons learned from previous activities.

Once at the task site, personnel are responsible for identifying any potentially unsafe situations or conditions for corrective action to the FTL, JSS, or HSO. If it is perceived that an unsafe condition poses an imminent danger, all task site personnel are authorized to stop work immediately and then notify the FTL, JSS, or HSO.

1.3.16 Quality Engineer

The quality engineer provides guidance on task site quality issues when requested. The quality engineer observes task site activities and verifies that the operations comply with the pertinent quality requirements. The quality engineer identifies activities that do not comply or have the potential for not complying with quality requirements and suggests corrective actions. Corrective actions are submitted to the PM.

1.3.17 Environmental Compliance Coordinator

The environmental compliance coordinator oversees, monitors, and advises the PM and FTL on environmental issues and concerns by ensuring compliance with DOE orders, EPA regulations, and other regulations concerning the effects of task site activities on the environment. The environmental compliance coordinator provides support surveillance services for hazardous waste storage and transport and surface water or storm water runoff control. The environmental compliance coordinator assists the FTL in completing the JRC.

1.3.18 Waste Generator Services

Waste Generator Services is responsible for characterizing, classifying, and shipping waste including investigation-derived waste (IDW) that is generated from sampling, decontamination, and emergency situations that generate waste.

1.3.19 Nonworkers

All persons who may be on the project task site, but are not part of the field team, are considered nonworkers for the purposes of this project (surveyors, equipment operators, or other crafts personnel not assigned to the project). A person is considered onsite when he or she is in or beyond the designated support zone. Nonworkers will be deemed occasional site workers in accordance with 29 CFR 1910.120 and 1926.65 and must meet minimum training requirements for such workers, as described in the OSHA standard, and any additional site-specific training, as identified in the project HASP.

All nonworkers, including INEEL employees who are not working on the project or who are nonessential representatives of DOE or state or federal regulatory agencies, may not proceed beyond the support zone. Nonworkers who proceed beyond the support zone must receive task-specific HASP training, sign a task-specific HASP training acknowledgment form, receive a safety briefing, wear the appropriate protective equipment, and provide proof of meeting the training requirements specified in the project HASP. A fully trained task site representative such as the FTL, JSS, HSO, or designee escorts nonworkers at all times while on the task site.

1.3.20 Visitors

All visitors, including INEEL employees who are not working on the project or who are nonessential representatives of DOE or state or federal regulatory agencies, may not proceed beyond the support zone. Visitors who proceed beyond the support zone must receive task-specific HASP training, sign a task-specific HASP training acknowledgment form, receive a safety briefing, wear the appropriate protective equipment, and provide proof of meeting the training requirements specified in the project HASP. A fully trained task site representative, such as the FTL, JSS, HSO, or designee, escorts visitors at all times while on the task site.

A casual visitor to the task site is a person who does not have a specific task to perform or other official business to conduct. Casual visitors are not permitted at the task site for the INTEC injection well.

2. SITE DESCRIPTION AND BACKGROUND

2.1 Site Background

The INEEL is a U.S. Government-owned facility managed by the DOE. The eastern boundary of the INEEL is located 52 km (32 mi) west of Idaho Falls, Idaho. The INEEL site occupies approximately 2,305 km^2 (890 mi^2) of the northwestern portion of the Eastern Snake River Plain in southeast Idaho. The INTEC is located in the south-central portion of the INEEL as shown in Figure 2-1

From 1952 until 1992, the mission of the INTEC served as a nuclear reprocessing facility for defense projects, research, and storage of spent nuclear fuel (SNF). Depending on the type of fuel reprocessing operations, several types of radioactive liquid waste were produced at the INTEC. In 1992, the DOE announced that fuel reprocessing at INTEC would be phased out. The current mission for the INTEC includes management and storage of SNF, treatment and storage of high-level waste generated during past spent nuclear fuel reprocessing, and low-level waste generated primarily from decontamination and other ongoing and future operations and activities. The INTEC was formerly designated as the Idaho Chemical Processing Plant (ICPP). To more closely reflect its current mission, the facility was redesignated the Idaho Nuclear Technology and Engineering Center (INTEC) in 1998.

Releases of radioactive and hazardous waste to the environment have occurred at the INTEC over the past decades because of accidents and previously acceptable operational releases, such as injection of radionuclide-contaminated wastewater into the Snake River Plain Aquifer (SRPA) beneath the perimeter of the INTEC fenceline. In 1989, the INEEL was added to the EPA National Priorities List (NPL) (54 FR 48184) and became subject to CERCLA. Contaminated sites at the INTEC contributed to listing the INEEL on the NPL. When the FFA/CO was negotiated, the INEEL was divided into 10 WAGs and the INTEC was designated WAG 3.

Only limited investigations have been conducted at the injection well as it was filled with concrete in 1989. Some samples were collected from the material in the bottom of the well, but only from the top of the sediment. Site CPP-23 has been investigated in a Track 2 study and in the OU 3-13 Comprehensive RI/FS. These investigations were unable to meet the objectives of this investigation, as presented in Section 1.1 of this Field Sampling Plan and as a consequence, this FSP has been prepared to ensure all pertinent data quality objectives (DQOs) will be met. The INTEC injection well and the proposed monitoring well locations are shown in Figure 2-2.

2.2 Source, Nature, and Extent of Contamination

The former INTEC injection well was the primary source for liquid waste disposal from 1952 through 1984 and was used intermittently for emergencies until 1986. The average discharge to the well during this period was approximately 1.4 B L/year (363 M gal/year) or approximately 3.8 M L/day (1 M gal/day). It has been estimated that a total of 22,000 Ci of radioactive contaminants has been released in 4.2×10^{10} L (1.1×10^{10} gal) of water. The majority of the radioactivity (approximately 96%) is attributed to H-3 (DOE-ID 1997).

The Track 2 Summary Report for CPP-23 CPP Injection Well (1994), Comprehensive RI/FS for OU 3-13 at the INEEL – Part A, RI/BRA Report (DOE-ID 1997) and the OU 3-13 Record of Decision (DOE-ID 1999) identified several contaminants that may have been discharged to the injection well. Based on these reports, the contaminants of potential concern (COPCs) for the injection well include I-129, Sr-90, Pu-isotopes, H-3, Am-241, Tc-99, Cs-137, Co-60, Eu-152/-154, arsenic, chromium, mercury, nitrate/nitrite, and osmium.

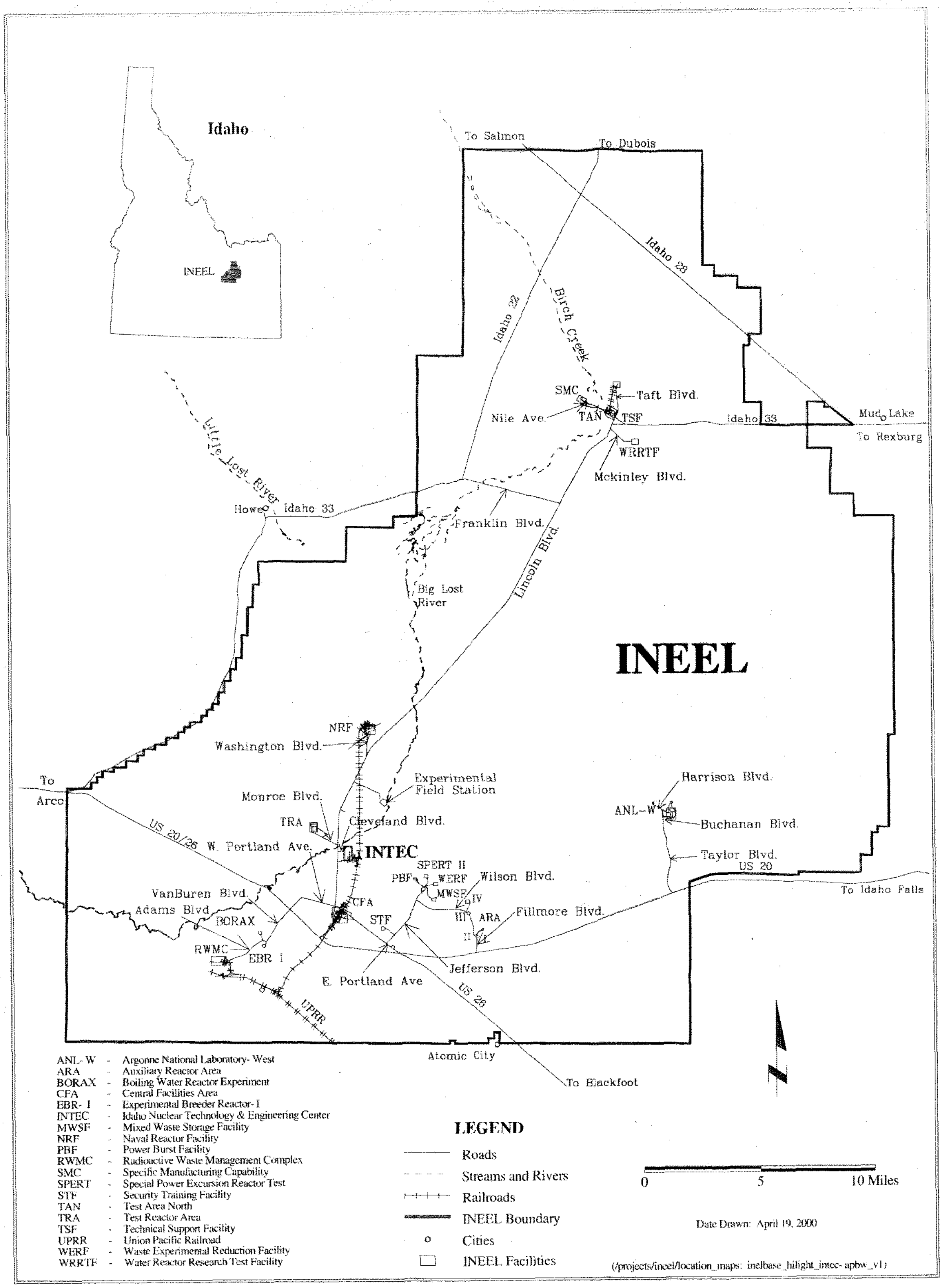

Figure 2-1. Map of the INEEL showing the location of the INTEC.

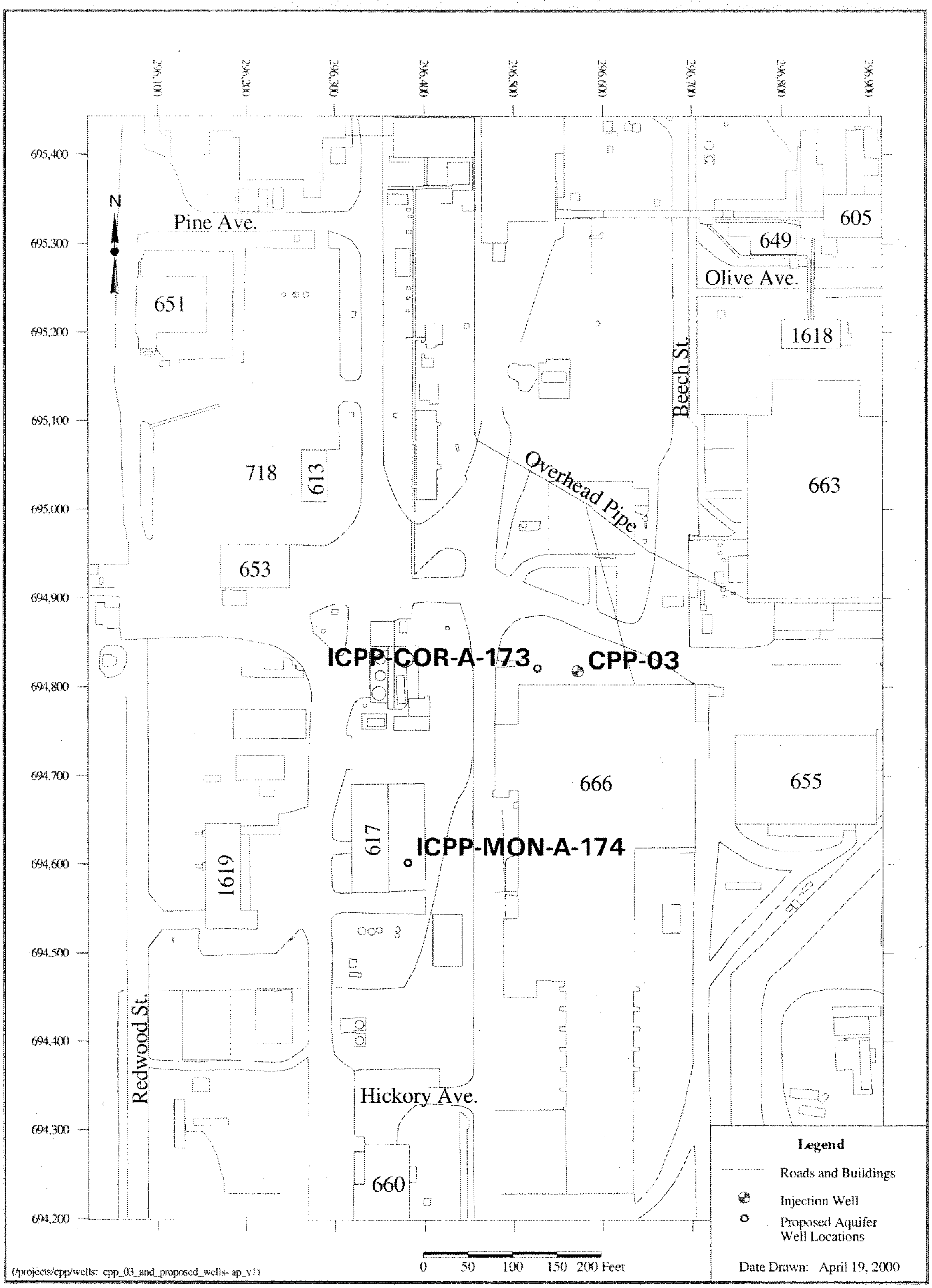

Figure 2-2. INTEC injection well (CPP-03) and proposed monitoring well locations.

The well was initially drilled in 1950 to a depth of 65 m (212 ft) below ground surface (bgs) and abandoned. In 1952 the borehole was cleaned out and deepened to a depth of 182 m (597 ft) bgs. The 61 cm (24 in.) diameter hole was cased with 0.8-cm (5/16-in.) thick carbon steel casing and perforated from 149 to 180 m (489 to 591 ft) bgs. A second set of perforations, above the water table and spanning 126 to 138 m (413 to 452 ft) bgs was added after well development to provide air outlets. The well had a total of 1.5 m^2 (16 ft^2) of perforations below the water table and 0.5 m^2 (6 ft^2) above the water table.

The injection effect of the INTEC injection well created high groundwater velocities immediately around the release point, as much as 1,524 m (5,000 ft) per day. This effect became insignificant at distances greater than 305 m (1,000 ft) from the disposal well. Water initially moved radially out around the well for some distance, overcoming the regional flow direction. Wastewater may have been injected at several depths, depending on well perforations.

There are two periods of casing disintegration (1967 or 1968 and 1981) and repair (1971 and 1982). During repair periods, the waste was injected into USGS-50, a well completed at 123 m (405 ft) bgs and located approximately 183 m (600 ft) north of the INTEC injection well.

3. FIELD SAMPLING PLAN OBJECTIVES

3.1 Data Needs

Data that are required by the FSP are intended to address the overall sampling objectives described in Section 1.1 and the specific DQOs developed for OU 3-14 as presented in Appendix B. The injection well (CPP 23) is known to have received the following analytes: I-129, Sr-90, plutonium isotopes, H-3, arsenic, chromium, mercury, nitrate/nitrite, Am-241, Tc-99, Cs-137, Co-60, Eu-152/154, and osmium (DOE-ID 1999). In addition, the injection well has completed RCRA closure as described in the Final Closure Plan for LDU CPP-23 Injection Well (MAH-FE-PL-304) (DOE-ID 1990). In section 2.1 of this closure plan, it states that "The only known contaminant release to the well identified as a RCRA concern is the mercury release which occurred in March 1981."

As part of the closure effort, a sediment sample was collected from the injection well by the USGS on August 31, 1989 and analyzed for 40 CFR 261 Appendix VIII hazardous constituents, for which EPA-approved methods exist. Analyses of the sediment sample detected traces of metals, radioactivity, and PCBs. No organic compounds, other than PCBs, were detected in the sediment sample from the injection well. The closure plan also required the collection and Appendix VIII analysis of groundwater samples from the adjacent wells (USGS-40 and USGS-47) and the production well (Production Well #1). These results also did not detect organic compounds in the groundwater.

Based upon these results, it appears that the COPCs for the injection well consist of radionuclides, metals, and PCBs. For completeness and to address possible uncertainties, the sediments from the injection well will also be sampled for the nine listed waste constituents previously identified at INTEC (benzene, carbon disulfide, carbon tetrachloride, hydrogen fluoride, pyridine, tetrachloroethylene, toluene, 1,1,1-trichloroethane, and trichloroethylene). In addition, the following constituents (acetone, cyclohexane, cyclohexanone, ethyl acetate, methanol, methyl isobutyl ketone, and xylene) were identified to be present in INTEC waste streams (INEEL/EXT-98-01212, revision 1, February 1999) and will be sampled

The following subsections describe the data needs as they specifically pertain to aquifer contaminant and sediment properties.

3.1.1 Aquifer Contaminant Properties

Samples will be collected to fulfill the objective of characterizing contaminant properties. The characterization will assist in determining the appropriate remedial action that needs to be implemented for safeguarding the portion of the Snake River Plain Aquifer beneath the perimeter of INTEC. Specific analytes that will be used to make this determination are summarized in the Sampling and Analysis Plan (SAP) tables (see Appendix A).

3.1.2 Sediment Concentration and Physical Properties

Sediments accumulated inside the former injection well require contaminant and physical property characterization. Analytical testing for the sediment includes those parameters in the SAP tables (see Appendix A). The characterization data will be used to evaluate risk and propose remedial actions. Sediment physical properties will include descriptions by the onsite geologist and will not include offsite analytical testing.

4. FIELD ACTIVITIES

The following sections describe the procedures and sampling equipment to be used for the planned coring, drilling, sampling, analyses, and field measurements described in this FSP. Before beginning any field activities, including drilling and coring, a pre-job briefing will be held to review the requirements of the FSP, HASP, and other work controlling documentation and to verify that all supporting documentation has been completed. At the termination of the field activities, a post-job review will be conducted. Both of these activities will be in accordance with INEEL MCP-3003, "Performing Pre-Job Briefings and Post-Job Reviews."

4.1 Drilling and Coring the INTEC Injection Well

The following coring and drilling approach may be modified to respond to unanticipated field conditions, or based on discussions with the selected drilling contractor. The Agencies will be notified of any planned changes for their concurrence with the new approach.

The former INTEC injection well will be drilled to an approximate depth of 137.2 m (450 ft) and then cored to approximately 185.9 to 198.1 m (610 to 650 ft) bgs (see Figure 4-1). The coring will be performed to collect sediment from the bottom of the well. Field screening and sampling of drill cuttings and core will be conducted onsite with appropriate radionuclide monitoring field instruments (Ludlum 2A or equivalent) to determine the presence or absence of radionuclide contaminants. If radionuclide contaminants are detected in the basalt at the bottom (approximately 182.3 m [598 ft] bgs) of the injection well, then coring operations will continue until the basalt core is absent of radionuclide contamination. It is anticipated that the injection well may be cored to a maximum of 198 m (650 ft) bgs to encounter non-contaminated basalt.

4.1.1 Drilling Methods Specifications

Drill, using air rotary technique, a 91.4-cm (36-in.) (nominal) or larger borehole into the abandoned INTEC injection well (CPP-23) vault cement cap and gravel fill from the land surface to a depth of approximately 6.1m (20 ft) bgs or to the top of the cement well plug. A Dust Hog containment system will be used to limit contamination from cuttings released to the atmosphere or surface. The cuttings will be containerized and monitored for radiation. Remove any gravel encountered in the area of the vault. The 91.4 cm (36-in.) borehole will be drilled to locate the existing injection well casings at approximately 6.1 m (20 ft) bgs. After the well casing is located, the drill rig will be set-up over the location of the injection well to continue drilling. A 20.3-cm (8-in.) (nominal) borehole will be advanced inside the center 25.4-cm (10-in.) casing of the abandoned injection well to approximately 1.5 m (5 ft) into the cement plug (6.1 to 7.6 m [20 to 25 ft] bgs). A 15.2-cm (6-in.) (nominal) carbon steel surface casing American Standards for Testing and Materials (ASTM) A53, (single "V"-groove weld connections) will be installed. Current staff are available for consultation who were present when the injection well vault was cemented. Further attempts to locate the injection well casing with the 36-inch diameter drill bit are considered unlikely, but will be considered if necessary.

Grout the 15.2-cm (6-in.) (nominal) steel casing in place by filling the annulus between the casing and the gravel fill with a grout mixture of Type I or Type II cement, 5% granular sodium bentonite, and 7 to 9 gal of water per 94-lb bag of cement.

Drill out any grout from inside the surface casing and advance (reverse circulation air rotary) a 10.2-cm (4-in.) borehole to an approximate depth of 137.2 m (450 ft) bgs. A surface diversion will be attached to the surface casing to aid in containment of all cuttings and circulation fluid. The cutting and circulation fluid will be diverted and discharged through a closed containment system (i.e., Dust Hog) with back flush capabilities on the filters. The containment system will also be constructed to allow the installation of a Flanders-type high-efficiency particulate air (HEPA) filtration system after the pre-filters, if necessary.

Install a conductor pipe in the borehole. The conductor pipe must be of sufficient size to accommodate NX-size (5.39 cm [2.13 in.] OD) coring activities. Advance the NX-size corehole through the center of the inside 25.4-cm (10-in.) injection well casing to the basalt at the bottom of the abandoned injection well. Radionuclide field screening and surveying analysis will be conducted throughout coring operations to determine the presence or absence of radionuclide contaminants.

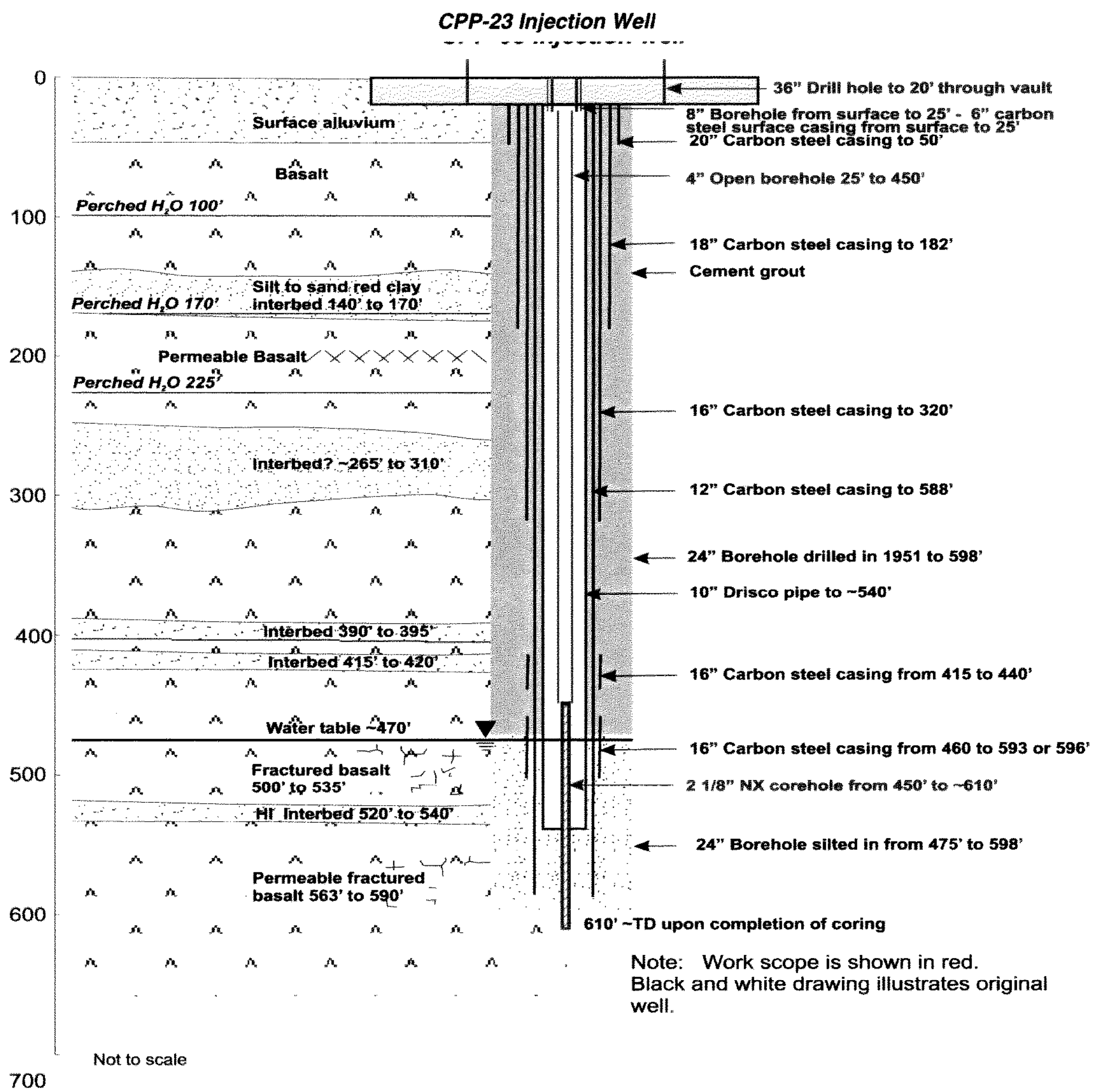

Figure 4-1. Conceptual coring design for the INTEC Injection Well (CPP-23).

The sediment and basalt will be cored by taking a continuous 1.5-m (5-ft) core sample using a bottom-discharge rotary diamond bit and wireline core recovery system. The driller will furnish a minimum of five wireline core recovery barrels (1.5-m [5-ft] split barrels) for all coring operations. Cores will be withdrawn at the first sign of blockage or grinding. If core recovery is poor or breakage is excessive, the driller will make every effort to improve the recovery and sample quality by changing bits, changing bit types, altering drilling rates, shortening runs, changing drilling fluid (water) circulation, or whatever other methods are required. No drilling fluid other than air or water will be allowed.

The material beneath the abandonment grout is anticipated to be a composite of deteriorated steel well casing, sedimentary and basalt fines, and sediments from past injected liquid waste streams. It is unknown whether the collapse zone in the injection well is localized or if the entire portion below the 137 m (450 ft) level has been infilled. Different coring techniques may be needed to successfully retrieve samples beneath the collapsed zone. If the sample material is competent, then conventional coring techniques utilizing a catcher or basket apparatus above the coring shoe should be adequate to retrieve the sample. If the material is less competent, then other sampling techniques will be utilized.

Upon coring to the appropriate depth, the corehole/borehole will remain open until sampling data obtained during this investigation are available and preliminary evaluation is complete.

Well abandonment procedures will be followed according to INEEL protocol.

If it is suspected that the drill bit has deviated to the point of perforating the 30.48 cm (12-in.) casing, then at the discretion of the driller, drill site geologist, and/or field team leader, downhole video and deviation logs can be utilized to check straightness of the 10.2 cm (4-in.) borehole. If this boring breaches the existing casing before the target depth is reached, one attempt will be made to re-center the boring, continue drilling and coring within the existing well structure, and complete this task.

If necessary, this re-drilling effort will be evaluated on-site with the driller and in consultation with DOE-ID, EPA, and IDEQ, and might include, but not be limited to, one or more of the following drilling techniques: grouting the bottom of the boring, re-drilling or re-coring using the same or a different type of drill bit, or using a smaller diameter pilot hole. If the breach cannot be remedied, the decision to quit the hole or advance the boring outside the casing and collect aquifer material adjacent to the former injection well will be assessed in consultation with the driller, DOE-ID, EPA, and IDEQ, probably via a conference call.

4.2 Coring and Drilling Aquifer Monitoring Wells ICPP-MON-A-173 and ICPP-MON-A-174

The completion of wells ICPP-MON-A-173 and ICPP-MON-A-174 includes a combination of drilling and coring. The wells will be cored from the top of the basalt (approximately 15 m [50 ft] bgs) to the bottom of the well. Well ICPP-MON-A-174 will be drilled approximately 91 m (300 ft) downgradient from the INTEC injection well. The final total depth of the wells will be determined based on drilling activities in the INTEC injection well.

A 55.9-cm (22-in.) or larger borehole will be drilled through the alluvial sediments from land surface into competent basalt at a depth of approximately 15.2 m (50 ft); 45.7-cm (18-in.) casing will be set to this depth. Coring will commence with NX size core [5.40 cm (2.13 in.)] and advanced through the first significant interbed to a depth of approximately 51.8 m (170 ft). If significant water is encountered, the hole will be reamed to a diameter of 45.4-cm (17 7/8-in.) and 35.6-cm (14-in.) casing will be installed. Coring will again progress through the second significant interbed to a depth of approximately 94.5 m (310 ft). If significant water is encountered, the hole will be reamed to this depth as a 35.2-cm

(13 7/8-in.) borehole and 25.4-cm (10-in.) casing will be installed. From this point, coring will continue to total depth as determined by information gained in drilling the INTEC injection well. Upon completion of the coring operations, the hole will be reamed to a diameter of 25.1-cm (9 7/8-in.) to accommodate a 15.2-cm (6-in.) diameter well casing. Final monitoring well design will be determined following an evaluation of radiation levels in the core based on field measurements, borehole lithologic, and geophysical logs with the minimum objective to set discrete 20-ft well screens near the water table, within or near the HI interbed, and below the HI interbed.

4.2.1 Drilling Methods and Specifications

The monitoring wells will be drilled to an approximate depth of 185.9 m (610 ft) bgs, but the depths may change based upon the results of the former injection well drilling and associated coring operations. Both ICPP-MON-A-173 and ICPP-MON-A-174 will be cored from the surficial sediment/basalt interface (approximately 15 m [50 ft] bgs) to the predetermined total depth.

The following paragraphs describe the monitoring well drilling, installation activities, and specifications.

Drill a 55.9-cm (22-in.) (nominal) or larger borehole in the alluvial sediments from the land surface downward into competent basalt approximately 15.2 m (50 ft), and install 45.7-cm (18-in.) (nominal) Schedule 40 carbon steel surface casing. Alluvial sediments and basalt drill cuttings will be logged for lithologic description at 1.5-m (5-ft) intervals.

Grout in place the 45.7-cm (18-in.) (nominal) carbon steel casing by filling the annulus between the casing and the alluvial sediments with a grout mixture of Type I or Type II cement, 5% granular sodium bentonite, and 7–9 gal of water per 94-lb bag of cement.

After the surface-casing grout has set, install a conductor pipe in the borehole. The conductor pipe should be of sufficient size to accommodate NX-size ([5.39 cm] 2.13-in.) coring activities. Collect an NX-size core in a continuous depth interval from approximately 15.4 m (50 ft) bgs to the base of the first significant sedimentary interbed encountered during coring (approximately 51.8 m [170 ft] bgs).

Cores shall be withdrawn at the first sign of blockage or grinding. If core recovery is poor or breakage is excessive, the driller shall make every effort to improve the recovery and sample quality by changing bits, changing bit types, altering drilling rates, shortening runs, changing drilling fluid (water) circulation, or whatever other methods are required. No drilling fluid other than air or water will be permitted.

If significant water is encountered, ream the corehole by advancing a 45.4-cm (17 7/8-in.) (nominal) borehole to an approximate depth of 51.8 m (170 ft) bgs, and install 35.6-cm (14-in.) (nominal) schedule 40 carbon steel casing. Resume coring to the next significant sedimentary interbed if significant water is not encountered.

A surface diversion will be attached to the surface casing to ensure complete containment of all cuttings and circulation fluid. The cuttings and circulation fluid will be discharged through a closed containment system with back flush capabilities on the filters. The containment system will also be constructed to allow the installation of Flanders-type or equivalent high-efficiency particulate air (HEPA) filtration system, if necessary. If water is generated during the drilling operation, the water will be diverted to holding tanks.

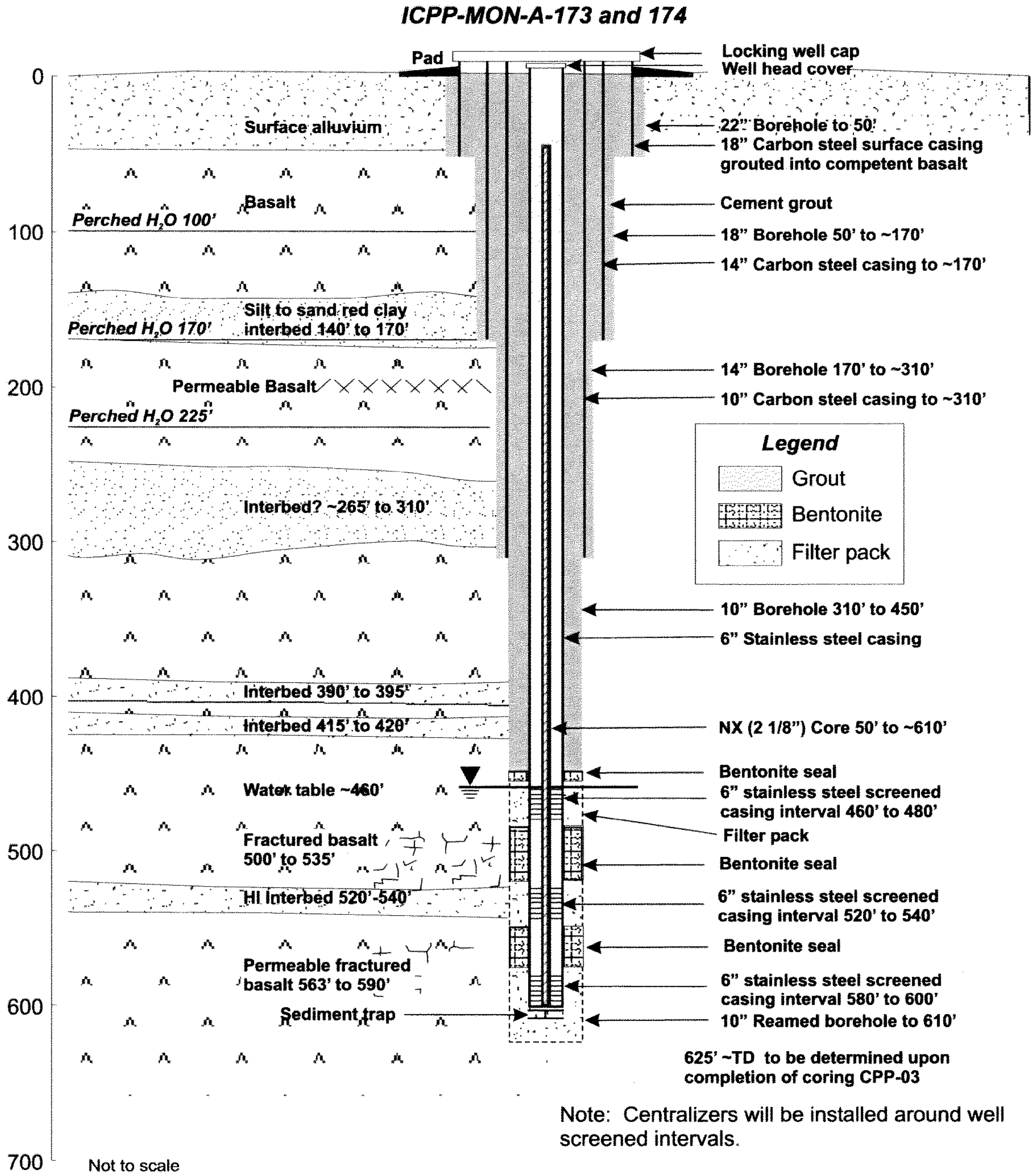

Figure 4-2. Conceptual coring and monitoring well design for ICPP-MON-A-173 and ICPP-MON-A-174.

After reaming/drilling a 45.4-cm (17 7/8-in.) diameter borehole to an approximate depth of 51.8 m (170 ft) bgs, geophysical borehole logging will be completed. Either the drill stem or a sufficiently large diameter pipe will be installed into the borehole to prevent the loss of the radiological source used for neutron and gamma-gamma geophysical logging. After removing the drill pipe, the U.S. Geological Survey (USGS) will perform additional geophysical logging (caliper, video, and natural gamma).

Grout the 35.6-cm (14-in.) (nominal) carbon steel casing in place by filling the annulus between the casing and the geologic formation with a grout mixture of Type I or Type II cement, 5% granular sodium bentonite, and 7–9 gal of water per 94-lb bag of cement provided by the driller.

Install conductor pipe. Resume coring at approximately 51.8 m (170 ft) bgs to a depth coincident with the base of the next significant sedimentary interbed (expected depth is approximately 94.5 m [310 ft] bgs). If a significant amount of perched water is encountered, retrieve the conductor pipe once the appropriate coring depth has been reached.

Drill out any grout from inside the 35.6-cm (14-in.) casing and advance a 35.2-cm (13 7/8-in.) (nominal) borehole to an approximate depth of 94.5 m (310 ft) bgs and install 24.5-cm (10-in.) (nominal) schedule 40 carbon steel casing.

After reaming/drilling a 35.2-cm (13 7/8-in.) diameter borehole to an approximate depth of 94.5 m (310 ft) bgs, geophysical borehole logging will be completed. Either the drill stem or a sufficiently large diameter pipe will be installed into the borehole to prevent the loss of the radiological source used for neutron and gamma-gamma geophysical logging. After removing the drill pipe, the U.S. Geological Survey (USGS) will perform additional geophysical logging (caliper, video, and natural gamma).

Grout the 25.4-cm (10-in.) (nominal) carbon steel casing in place by filling the annulus between the casing and the geologic formation with a grout mixture of Type I or Type II cement, 5% granular sodium bentonite, and 7–9 gal of water per 94-lb bag of cement.

If a significant amount of perched water is not encountered, continue coring to the predetermined total depth (approximately 186 to 198 m [610 to 650 ft]). Retrieve the conductor pipe once the appropriate coring depth has been reached.

Once coring operations have ended, ream the corehole by advancing a 25.1-cm (9 7/8-in.) (nominal) diameter borehole to the predetermined total depth (approximately 186 to 198 m [610 to 650 ft]). This will allow for the construction of a 6-in diameter monitoring well.

4.2.2 Well Construction

Following reaming operations to expand the borehole to 9 7/8-in diameter, borehole geophysical and fluid logging will be conducted to characterize the borehole and borehole flow conditions. The final logging activities should occur no sooner than 24 hours following completion of the borehole to allow stabilization of the borehole flow conditions. Borehole logging methods that will be conducted are described in Section 4.2.4 below.

Based upon our current conceptual model of the aquifer beneath INTEC, the key zones to be monitored include water table conditions, either near or within the HI interbed (as borehole conditions allow), and below the HI interbed. Following completion of the borehole logging, the resulting data will be evaluated to determine the optimum well construction design and screen placements.

Borehole logs above and below the HI interbed will be evaluated to locate primary groundwater flow paths within the fractured rock basalts as these are the most likely pathways for contaminants from the injection well source and most likely locations of elevated concentrations of residual contaminants adsorbed to the aquifer. These zones can be identified through evaluation of the geophysical logs to locate highly fractured zones and zones where significant groundwater flow is either entering or exiting the borehole. It is anticipated that at least one screened zone will be located at the primary fracture zones above and below the HI interbed with the possibility for several zones to be screened depending upon conditions encountered.

Table 4-1. Well construction specification list.

Well Name	Hole Diameter (in.)	Hole Depth (ft)	Construction Interval (ft)	Casing Size (in diameter)	Comments
ICPP-MON-A-173	36	0 to 50	0 to 50	18-in. CS	
	2-1/8 (coring)	50 to ~170			
	17 7/8 (reaming)	50 to ~170	0 to ~170	14-in. CS	
	2-1/8 (coring)	170 to ~310			Final 6-in well completion TBD following borehole testing
	13 7/8 (reaming)	170 to ~310	0 to ~310	10-in. CS	
	2-1/8 (coring)	310 to ~610			
	9 7/8 (reaming)	310 to ~610	TBD	6-in. SS casing	
			TBD	6-in. SS screen	
		610 to ~615	TBD	6-in. SS casing and cap	Sump/sediment trap
ICPP-MON-A-174	36	0 to 50	0 to 50	18-in. CS	
	2-1/8 (coring)	50 to ~170			
	17 7/8 (reaming)	50 to ~170	0 to ~170	14-in. CS	Final 6-in well completion TBD following borehole testing
	2-1/8 (coring)	170 to ~310			
	13 7/8 (reaming)	170 to ~310	0 to ~310	10-in. CS	
	2-1/8 (coring)	310 to ~610			
	9 7/8 (reaming)	310 to ~610	TBD	6-in. SS casing	
			TBD	6-in. SS screen	
		610 to ~615	TBD	6-in. SS casing and cap	Sump/sediment trap
CPP-23	36	0 to 20	0 to 25	6-in. CS	Set surface casing for coring operations
	8	20 to 25			
	4	25 to 450			
	2-1/8	450 to 610	NX-size coring		

CS = carbon steel SS = stainless steel

A conceptual design for the aquifer monitoring well is shown on Figure 4-2. The final inside well casing from land surface to the first screened zone, and between screened zones, will be constructed of 6-in. nominal, flush threaded, schedule10 stainless steel. Well screens will consist of 6-in. nominal, flush threaded, wire wrapped, 20 slot (0.02 inch openings) stainless steel. Screen lengths will likely be 20 feet, though field conditions and final well design considerations may result in shorter screen lengths, in particular where the screen is set adjacent to the HI interbed zone. Centralizers will be used adjacent to well screens to allow for proper filter pack emplacement. A silica-sand filter pack will be installed in the borehole annular space adjacent to each well screen. The filter pack will be installed a minimum of 5 feet above and below the top and bottom of each screen to ensure well seal material does not affect well screen performance. The annular space between filter packs, and above the top filter pack will be sealed with granular bentonite.

4.2.3 INTEC Aquifer Monitoring Well Development

The monitoring wells will be developed by initially surging the water within the casing and screen using a surge block attached to the tremie pipe. After surging the well, submersible pump will be used to complete well development. Development of the well will continue until the specific conductance, temperature, pH, and color of the water are stable. Following well development, a bailer will be used to remove any accumulated sediment from the sump.

A dedicated submersible sampling pump (Grundfos Redi-Flo4 5E25 or equivalent) will be installed following well development. The submersible pump will be attached to 1-in, inside diameter (ID) stainless steel riser pipe that extends 0.76 m (2.5 ft) above land surface. Prior to pump installation, the pump and the discharge pipe will be decontaminated. Only Teflon tape will be allowed as a lubricant to join the discharge pipe sections. The electrical utilities will be attached with plastic connectors to the discharge pipe approximately every 1.5 m (5 ft).

Well site completion (locking well-head box, well pad, impingement posts, brass marker) will be installed. A cement pad will be poured in a square form around the surface casing. The cement pad will be roughly 1.2 × 1.2 m (4 × 4 ft) and the cement will slope downward away from the surface casing.

Three impingement posts, one removable, shall be installed. Posts will be installed to a depth of 0.8–0.9 m (2.5–3.0 ft) bgs and cemented in place. They will be constructed of 10.2-cm (4-in.) schedule 40 carbon steel and will stand approximately 0.8 m (2.5 ft) above ground surface.

A locking cap (i.e., hinge and hasp lock) will be installed on the 15.2-cm (6-in.) stainless steel casing to prevent materials from entering the well.

4.2.4 Downhole Geophysical Logging

When the target depth is reached, each hole will receive a complete suite of physical and geophysical downhole geologic logs. At a minimum, this suite will consist of video, caliper, natural gamma, deviation, gamma-gamma, density, neutron, and high-resolution gamma spectroscopy, as well as borehole fluid logs for flow rate, temperature, and specific conductivity. All geophysical logs will be used for comparison of information.

The INEEL field office of the USGS will perform the video, caliper, natural gamma, deviation, gamma-gamma, neutron logs, and borehole fluid logs. BBWI personnel will perform high-resolution gamma spectroscopy logs. Geophysical logs involving a radioactive source (gamma-gamma, and neutron) will be conducted inside the core string prior to its removal from the corehole. All other logs will be done in the open borehole.

4.2.5 Drilling and Sampling Equipment

Drilling will be conducted using a wireline core rig. Samples will be collected in cleaned, laboratory-method required containers. Only decontaminated drilling or sampling equipment will come in contact with the sample material prior to, during, or after sample collection. A Lexan liner may be installed in the core barrel to ensure that the integrity of the sample will not be compromised by contamination. All drilling and sampling equipment and procedures will ensure no releases of contamination to the environment and all activities will be conducted in accordance with MCP-3480, "Environmental Instructions for Facilities, Processes, Materials, and Equipment." The drilling and sampling equipment will meet the following minimum design requirements:

- Provide radiation protection for personnel working with and around the drilling equipment. This will include all drilling and handling tools and equipment to retrieve the samples from the borehole and deliver them to INEEL field team personnel. Work with INEEL radiological engineers to modify existing subcontractor-owned equipment and design and manufacture the necessary equipment.
- Design, modify, or retrofit subcontractor-owned equipment or manufacture circulation systems that will ensure double containment of circulation effluent streams and containment systems
- Design, modify, or retrofit subcontractor-owned equipment that will maximize sample collection and minimize cuttings. All aspects of this project will keep waste production to a minimum.
- Design, modify, or retrofit subcontractor-owned equipment that can be maneuvered to fit within the limited drilling locations while providing maximum working space for personnel.

All drilling locations, selection, and positioning of drill rigs will be reviewed and approved by the appropriate INTEC personnel prior to the beginning of any sampling activities.

4.2.6 Drilling and Sampling Equipment Decontamination

All drilling equipment will be steam cleaned before entering the injection well area. Drilling equipment will be decontaminated between boreholes to ensure no cross-contamination from one borehole to another. Sampling equipment (e.g., inner barrels and quad latches) will be field cleaned (per the QAPjP and appropriate SOPs) between sampling runs. The equipment will be inspected for visible contamination, and if found, additional cleaning will be performed.

Equipment decontamination will be carried out by the subcontractor at a decontamination pad constructed by the subcontractor. The subcontractor will provide a decontamination pad consisting of an impermeable barrier that is secure at the edges using sandbags or other type of anchor. The pad will be sloped to a low spot where the water can be collected for sampling and disposal by the contractor. The contractor must approve the location of the decontamination pad.

The decontamination methods for the drilling and sampling equipment will ensure containing all decontamination fluids, minimizing waste, and minimizing contamination of equipment. Decontamination of the field equipment for the Tank Farm drilling will be performed as per SOP-11.4, "Field Decontamination of Heavy Equipment, Drill Rigs, and Drilling Equipment," and SOP 11.5, "Field Decontamination of Sampling Equipment." In addition, decontamination measures will be evaluated during the cold test demonstration, and necessary modifications will be made to ensure that containment, proper waste segregation, and waste minimization procedures will be in place prior to the start of drilling near the injection well.

4.2.7 Sampling Location Surveys

After drilling, sampling, and installation of monitoring equipment, all borehole location points will be surveyed in accordance with the requirements set forth in MCP-227, "Sampling and Analysis Process for Environmental Management Funded Activities."

4.3 Sampling Requirements and Procedures

The OU 3-14 INTEC injection well investigation will include the collection of samples from the sediments in the INTEC injection well and from the core and aquifer in ICPP-MON-A-173 and ICPP-MON-A-174 aquifer wells. The sampling requirements addressed in this FSP include field data collection including QA/QC samples, installation of monitoring equipment, and collection of solid sample material.

Sampling requirements for the drilling and coring operations are outlined below. Drilling and core samples will be collected in accordance with TPR-61 (formerly Standard Operating Procedure (SOP) 11.12), "Soil Sampling," and TPR-53 (formerly SOP 11.6), "Drilling and Installation of Monitoring Wells." Decontamination will be conducted in accordance with TPR-51 (formerly SOP 11.4), "Field Decontamination of Heavy Equipment, Drill Rigs and Drilling Equipment," and TPR-52 (formerly SOP 11.5), "Field Decontamination of Sampling Equipment," except that isopropanol will not be used.

4.4 Sampling Location and Frequency

4.4.1 INTEC Injection Well (CPP-23) Sampling

One boring will be attempted through the grout seal and sediment within the former INTEC injection well with the intent to collect a continuous core sample of the sediment remaining in the well. The approach is to drill through the grout seal and core the sediment remaining to the original depth of 182.9 m (600 ft). A single attempt will be made to drill, core, and sample to the original total depth of the injection well. If this effort is not successful, samples will be collected of materials from the depth attained. The core will be composite-sampled over the following 3-m (10-ft) intervals: 137 to 140 m, 146 to 149 m, 156 to 159 m, 165 to 168 m, 174 to 177 m, 183 to 186 m, and 192 to 195 m (450 to 460 ft, 480 to 490 ft, 510 to 520 ft, 540 to 550 ft, 570 to 580 ft, 600 to 610 ft, and 630 to 640 ft). Two additional samples may be collected at other depths to be determined from those portions of the sediment core that potentially contain contamination based on radiological field screening and visual observation. The coring will continue in 1.5 m (5-ft) increments past the bottom of the injection well until the radiological field screening or visual observations indicate that the vertical extent of contamination has been reached. Coring will continue for an additional 1.5-m (5-ft) interval below the depth where contamination was last observed. It is anticipated that the final depth of coring will be approximately 185.9 to 198.1 m (610 to 650 ft).

Each sample interval, totaling seven samples, will be collected by taking material in 1.5 m (5 ft) intervals, excluding the upper 15 cm (6 in),which is likely sloughed material that may have fallen back in the well during coring. As a result, each 3 m (10 ft) interval will consist of two 1.5 m (5 ft) sections. The first 1.5 m (5 ft) core barrel will remain closed and segregated until the second core barrel is retrieved, then both core barrels will be opened simultaneously to retrieve the sample. VOC samples will be collected from a discrete section of the cored material based upon field observations. The radionuclide, metals, PCB, and SVOC samples will be collected as composite samples from along the length of the core. The remaining core material (not collected as sample) will be archived in a drum. Core collected in that portion of well, not specified as a 3 m (10 ft) sampling interval, will also be archived. Thus, a total of nine samples may be collected from the cored interval.

4.4.2 INTEC Aquifer Monitoring Wells Sampling

Two additional aquifer monitoring wells will be drilled to investigate the SRPA groundwater quality beneath the perimeter of the INTEC. The wells will be completed in the aquifer to a depth that is consistent with the contamination profile determined from the injection well core. It is anticipated that the wells will completed with screened zones located near the water table, intersecting the HI interbed, and in the fractured basalt below the HI interbed. The actual screened intervals will be determined from the injection well core contamination profile, geophysical logs, and borehole fluid logs.

The proposed wells will be located as follows: (1) adjacent to the INTEC injection well, and (2) approximately 91.4 m (300 ft) downgradient of the INTEC injection well (see Figure 4-3). Each well is intended to be used as a point of investigation for evaluating potential residual contamination in the aquifer resulting from the use of the INTEC injection well. The proposed location of the downgradient monitoring well is based on the information presented in Appendix C.

4.4.2.1 ICPP-MON-A-173 Well Sampling. The ICPP-MON-A-173 well will be located adjacent to the INTEC injection well and in an area that is accessible, based on utilities and structures (Figure 4-3). The entire boring, from the top of the basalt to the total depth (depth of the bottom of contamination confirmed during injection well drilling) will be cored and the core archived for OU 3-14 future studies as necessary. This core will be examined closely for fractures and evidence of contamination. Continuous core will be attempted for lithologic description purposes and will be screened using a hand-held radiation detector (Ludlum 2a or equivalent).

The basalt and interbed sediments will be continuous-cored in wells ICCP-MON-A-173 and ICPP-MON-A-174 with 1.5-m (5-ft) core barrels using a bottom discharge rotary diamond bit and wireline core recovery system. Cores will be withdrawn at the first sign of blockage or grinding. If core recovery is poor or breakage is excessive, different methods to improve core recovery and sample quality will be evaluated, such as changing bits, changing bit types, altering drilling rates, shortening runs, changing drilling fluid (water) circulation, or other methods. No drilling fluid other than air or water will be allowed. A telescoping drilling method will be employed to ensure that caving of sedimentary interbeds or downward migration of water from any potential perched water zones does not occur.

Groundwater samples will be collected using a straddle packer system to isolate and sample from the discrete screened zones. These samples will be analyzed for the specific analytes presented in the SAP tables (Appendix A). The laboratory will dispose of the residue (both altered and unaltered).

4.4.2.2 ICPP-MON-A-174 Well Sampling. This well will be drilled approximately 91 m (300 ft) downgradient from the INTEC injection well, as described in Appendix C; Figure 4-3. Cores will be obtained from this well as described for ICPP-MON-A-173.

Groundwater samples will be collected from ICPP-MON-A-174 using a straddle packer system to isolate and sample from the discrete screened zones. These samples will be analyzed for the specific analytes presented in the SAP tables (Appendix A). The laboratory will dispose of the residue.

4.5 Personal Protective Equipment

The PPE required for these field activities is discussed in the Health and Safety Plan for Tank Farm Soils for the OU 3-14 RI/FS (INEEL 2000).

Prior to final dispositioning, a hazardous waste determination must be completed by following the requirements in INEEL MCP-62, "Waste Generator Services – Low-Level Waste Management."

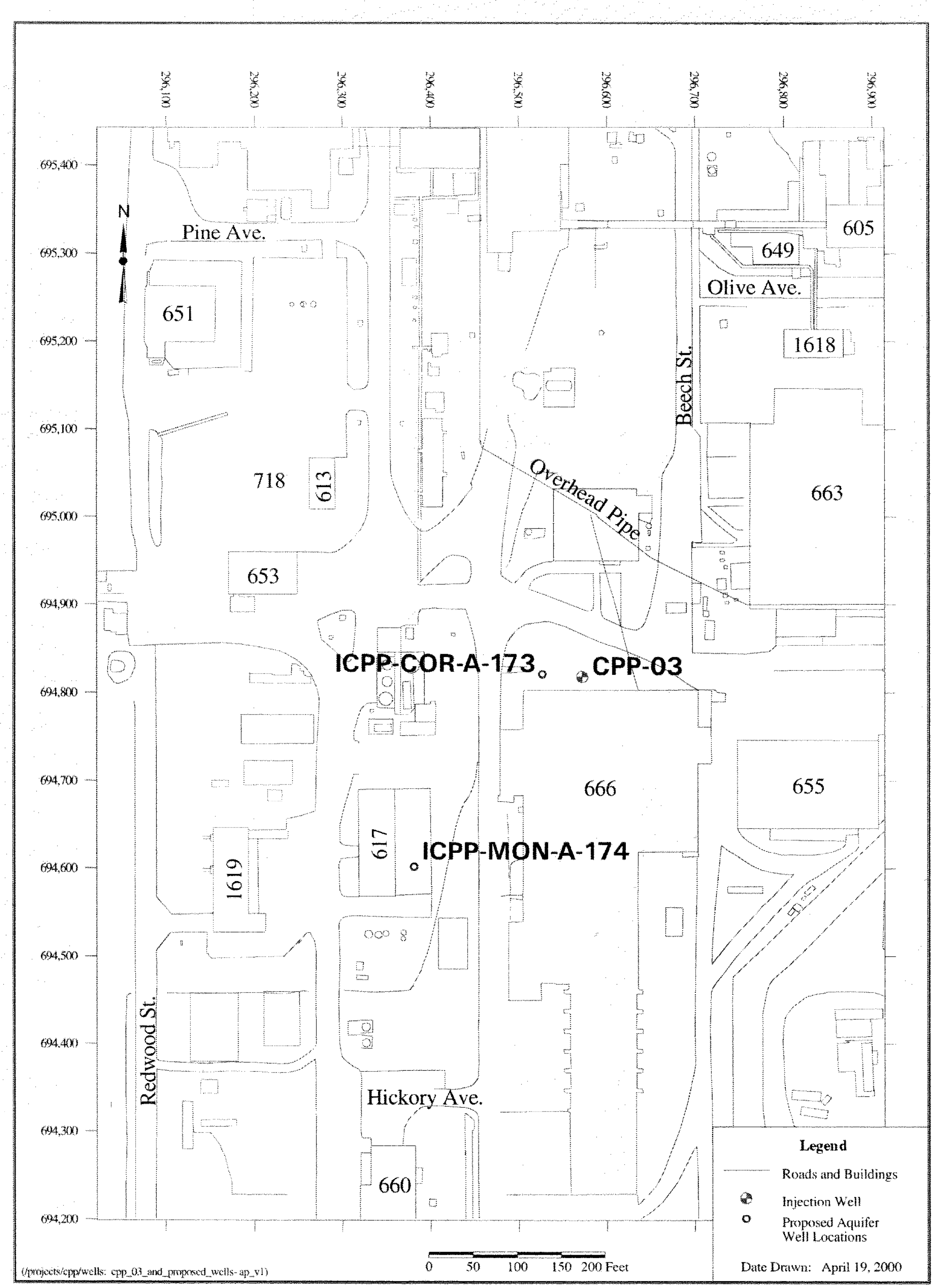

Figure 4-3. INTEC injection well (CPP-03) and proposed monitoring well locations.

4.6 Shipping Screening

Following sample collection, samples will be surveyed for external contamination and field screened for radiation levels. If necessary, a gamma screening sample will be collected and submitted to the Radiation Measurements Laboratory located at INTEC for a 20-minute analysis prior to shipment offsite. The radiological control technicians in the field will make this determination.

If it is determined that the contact readings on the samples exceed 200 mR/hour, then the samples will be held for analysis in the INTEC Analytical Laboratories.

4.7 Sampling Waste Management

Investigation-derived waste (IDW) generated during the OU 3-14 field investigation may include the following:

- Contaminated PPE, wipes, bags, and other paper and plastic trash
- Contaminated drilling and sampling equipment
- Aqueous decontamination solutions
- Metal and wood debris (e.g., temporary drilling platforms)
- Unused, unaltered, and altered sample material; and drill cuttings
- Used sample containers and disposable sampling equipment
- Aqueous and liquid organic analytical waste
- Analytical debris (e.g., glassware and pipettes).

The handling and identification of all waste generated during this investigation are discussed in detail in the Waste Management Plan for this project (INEEL 1999).

5. SAMPLE DESIGNATION

5.1 Sample Identification Code

A systematic character identification (ID) code will be used to uniquely identify all samples. Uniqueness is required for maintaining consistency and preventing the same ID code from being assigned to more than one sample.

The first two designators of the code refer to the environmentally controlled area (ECA) from which the sample originated. The third digit refers to the boring number associated with that ECA. The next three numbers designate the sequential sample number for the project. In most cases these refer to the specific sample interval in a boring, with the numbering beginning with 001 and the intervals being numbered from shallowest to deepest. A two-character set (e.g., **01**, **02**) will be used in the seventh and eighth designators of the code to identify field duplicate samples. The last two characters refer to a particular analysis and bottle type. Refer to the SAP tables in Appendix A for specific analysis code designations.

For example, a subsurface soil sample collected in support of the OU 3-14 injection well sampling might be designated as "**03A00101R4**," where (from left to right):

- **03** designates the sample as originating from the INTEC injection well
- **A** designates the sample as being collected from coring 03A
- **001** designates the first (most shallow) sample interval in coring 03A
- **01** designates the type of sample (01 = original, 02 = field duplicate)
- **R4** designates gamma spectrometric analysis.

The SAP tables/database will be used to record all pertinent information associated with each sample ID code.

5.2 Sampling and Analysis Plan Table

5.2.1 General

A SAP table format was developed to simplify the presentation of the sampling scheme for project personnel. It is based on planned sample locations, required analyses, and the analytical laboratory requirements. The following sections describe the information recorded in the SAP table (database), which is presented in Appendix A.

5.2.2 Sample Description Fields

The sample description fields contain information relating individual sample characteristics.

Sampling Activity—The sampling activity field contains the first six characters of the assigned sample number. The sample number in its entirety will be used to link information from other sources (e.g., field data and analytical data) to the information in the SAP tables for data reporting, sample tracking, and completeness reporting. The sample number will also be used by the analytical laboratory to track and report analytical results.

Sample Type—Data in this field will be selected from the following:

- REG — Regular
- TBLK — For trip blank
- FBLK — For Field blank
- RNST — For equipment rinsate
- DUP — For duplicate sample
- PES — For performance evaluation sample.

Media—Data in this field will be selected from the following:

- Groundwater — For regular and QA/QC sample
- Water — For regular and QA/QC sample
- Soil/Sludge — For regular and QA/QC sample.

NOTE: *Soil and basalt samples will not be submitted.*

Collection Type—Data in this field will be selected from the following:

- Composite — For composite sample
- QA/QC — For QA/QC sample
- Grab — For grab sample

Planned Date—This date is related to the planned sample collection start date.

5.2.3 Sample Location Fields

This group of fields pinpoints the exact location for the sample in the three-dimensional space, starting with the general AREA, narrowing the focus to an exact location geographically, then specifying the DEPTH in the depth field.

Area—The AREA field identifies the general sample collection area. This field should contain the standard identifier for the INEEL area being sampled. For this investigation, samples are being collected from the sites associated with the INTEC injection well. The area field identifier will correspond to this site identifier.

Location—This field may contain geographical coordinates, x-y coordinates, building numbers, or other location identifying details, as well as program specific information such as well number. Data in this field will normally be subordinate to the AREA. This information is included on the labels generated by the SMO to aid sampling personnel.

Type of Location—The type of location field supplies descriptive information concerning the exact sample location. Information in this field may overlap that in the location field, but it is intended to add detail to the location.

Depth—The DEPTH of a sample location is the distance in feet from surface level or a range in feet from the surface.

5.2.4 Analysis Types

AT1-AT20—These fields indicate analysis types (e.g., radiological, chemical, and hydrological). Space is provided at the bottom of the form to clearly identify each type. A standard abbreviation should also be provided if possible.

5.3 QA Objective for Measurement

The QA objectives for measurement will meet or surpass the minimum requirements for data quality indicators established in the QAPjP (DOE-ID 2000a). This reference provides minimum requirements for the following measurement quality indicators: precision, accuracy, representativeness, completeness, and comparability. Precision, accuracy, and completeness will be calculated in accordance with the QAPjP.

5.3.1 Precision

Precision is a measure of the reproducibility of measurements under a given set of conditions. In the field, precision is affected by sample collection procedures and the natural heterogeneity in the soil. Overall precision (field and laboratory) can be evaluated by the use of duplicate samples collected in the field.

Laboratory precision will be based on the use of laboratory-generated duplicate samples or matrix spike/matrix spike duplicate samples. Evaluation of laboratory precision will be performed during the method data validation process.

Field precision will be based on analysis of colocated field duplicate or split samples. For samples that are collected for laboratory analyses, a field duplicate will be collected at a minimum frequency of 1/20 environmental samples.

5.3.2 Accuracy

Accuracy is a measure of bias in a measurement system. Laboratory accuracy is demonstrated using laboratory control samples, blind quality control (QC) samples, and matrix spikes. Evaluation of laboratory accuracy will be performed during the method data validation process. Overall accuracy is affected by sample preservation and handling, field contamination, and the sample matrix in the field. The effects of the first three can be assessed by evaluation of the results of equipment rinsates. Field accuracy will be determined only for samples collected for laboratory analysis.

5.3.3 Representativeness

Representativeness is a qualitative parameter that expresses the degree to which the sampling and analysis data reflect the characteristics being measured. Representativeness will be evaluated by comparing the number of samples collected with the number necessary to be representative, and by confirming that sample locations were properly located.

5.3.4 Completeness

Completeness is a measure of the quantity of usable data collected during an investigation. Field sampling and field measurement completeness is affected by such factors as equipment and instrument malfunctions and insufficient sample recovery. The QAPjP requires an overall completeness goal of 90% for noncritical samples and 100% for critical samples.

Critical data points are sample locations for which valid data must be obtained for the sampling event to be considered complete. The critical data is absolutely necessary for a final determination to be made regarding the site being sampled. All core, drill cutting, and groundwater samples collected during the injection well drilling are considered noncritical. Therefore, an overall completeness goal for the sediment and groundwater samples is 90%. If collection of the injection well sediment is not technically feasible, then collection of adjacent basalt media will be used for attainment of completion goals. Completed installation of aquifer wells is considered critical to the overall objectives of the injection well drilling program.

5.3.5 Sample Prioritization

5.3.5.1 Sediment Sample Prioritization. Due to the difficulties inherent in the collection of samples from sedimentary interbeds and the sediment of the injection well and other monitoring wells, it is assumed that at some sample intervals targeted for characterization, a sufficient volume of sample material may not be available to meet all of the analytical needs. When insufficient sample material is recovered, the available sample material will be allocated to meet the following analytical requirements in the order or priority listed below:

1. Sediment characterization analytical samples
2. Aquifer matrix contaminant samples
3. Fate and transport study samples
4. Treatability studies archive samples.

For a specific analyte list and sample requirements for Injection Well sediment samples, see Table 5-1.

5.3.5.2 Water Sample Prioritization. Analytical prioritization is not anticipated to be necessary for groundwater sampling. Analytical requirements for water samples are: radionuclides (unfiltered), cations and anions, metals (filtered and unfiltered), VOCs, and SVOCs. There are no plans to sample the perched groundwater for two reasons. First, the core drilling will use water which will create erroneous perched water, and second, perched water should not be encountered in the injection well since it was grouted.

Table 5-1. Specific analyte list and sample requirements for Injection Well sediment samples.

Analysis	Analytical Requirements[g]	Sample Medium	Volume/Mass	Container Type[f]	Holding Time	Preservative
Gross Alpha (gross α)	Table 1-7	Soil	≥10g	Wide-mouth jar[b]	Analyze within 6 months[a,b]	None
Gross Beta (gross β)	Table 1-7	Soil	≥10g	Wide-mouth jar[b]	Analyze within 6 months[a,b]	None
Alpha Spectroscopy Americium (Am-241) Curium (Cm-242, 244) Neptunium (Np-237) Plutonium (Pu-238, 239/240, 242) Thorium (Th-228, 230, 232) Uranium (U-234, 235, 238)	Table 1-7	Soil	≥10g (per isotope or isotope combination)	Wide-mouth jar[b]	Analyze within 6 months[a,b]	None
Gamma Spectroscopy Antimony (Sb-125) Cerium (Ce-144) Cesium (Cs-134, 137) Cobalt (Co-60) Europium (Eu-152, 154, 155) Manganese (Mn-54) Ruthenium (Ru-106) Silver (Ag-108m, 110m) Zinc (Zn-65) Other[e] (Results $>2\sigma$ and $>$ MDA)[e]	Table 1-7	Soil	≥200g (per sample)	16 oz wide-mouth jar[b]	Analyze within 6 months[a,b]	None
Other Radionuclides Plutonium (Pu-241) Strontium (Sr-90) Technetium (Tc-99)	Table 1-7	Soil	≥10g (per individual isotope)	Wide-mouth jar[b]	Analyze within 6 months[a,b]	None
Tritium (H-3)	Table 1-7	Soil	5—200g	Wide-mouth jar[b]	Analyze within 6 months[a,b]	None
Iodine (I-129)	Table 1-7	Soil	10—15g	Wide-mouth jar[b]	Analyze within 6 months[a,b]	None

Table 5-1. (continued).

Analysis	Analytical Requirements[g]	Sample Medium	Volume/Mass	Container Type[f]	Holding Time	Preservative
CLP (TAL) metals	Table 1-6	Soil	250 mL	Wide-mouth glass jar	Analyze within 6 months, except analyze Hg within 28 days.[c]	4°C[c]
CLP (TAL) volatiles	Table 1-2	Soil	125 mL	Wide-mouth glass jar	Analyze within 14 days.[d]	4°C[d]
CLP (TAL) semivolatiles	Table 1-3	Soil	250 mL	Wide-mouth glass jar	Extract within 14 days, analyze extracts within 40 days of extraction.[d]	4°C[d]
PCBs	Table 1-4	Soil	250 mL	Wide-mouth glass jar	Extract within 14 days, analyze extract within 40 days of extraction[e]	4°C[e]
Anions	Table 1-13	Soil	250 mL	Wide-mouth glass jar	Analyze within 28 days	4°C
TPH (Method 8015) (gasoline range)	NA	Soil	125 mL	Amber glass	Analyze within 14 days	4°C
Cyclohexane		Soil	TBD[i]			
Cyclohexanone		Soil	TBD[i]			

a. The holding time requirement of 6 months is described in 40 (CFR) 136 (EPA guidelines for analysis of pollutants) and is applied in the QAPjP as a general guideline. For analysis of radionuclides with short half-lives, the holding time will be adjusted accordingly and communicated to the laboratory in a project-specific Task Order Statement of Work (SOW).

b. Sludge and sediment samples should be collected and preserved equivalently to soil samples. Samples known or suspected to contain solvents must use high-density polyethylene (HDPE) containers.

c. EPA 1993b, *Statement of Work Inorganic Analyses-Multi Media, Multi Concentration,* Contract Laboratory Program, ILM 030, June.

d. EPA 1993a, *Statement of Work Ogranic Analyses-Multi-Media, Multi Concentration,* Contract Laboratory Program, OLM 01.9, July.

e. EPA 1986, *Test Methods for Evaluating Solid Waste, Physical and Chemical Methods,* Third Edition, SW 486.

f. Certificate of cleanliness will be obtained for all lots of sample containers used.

g. The individual compounds or radionuclides and the associated contract required detection limits are identified in the referenced table of the QAPjP (DOE/ID-10587, Rev. 6, Sept. 2000).

i. To be determined in the laboratory TOS.

Filtered metals samples will be collected and analyzed to support the characterization of dissolved metals in groundwater and compare the analytical results to EPA action levels, which are dissolved concentrations. Unfiltered metals samples will be collected and analyzed to acquire total metals results which may be used in evaluating risk. The sample plan may be revised based on results. Comparison of filtered vs. nonfiltered results helps identify potential man-made water sample contamination sources such as introduced well completion or pump-related materials.

For a specific analyte list and sample requirements for the monitoring well groundwater and rinsate blank non-radiological and radiological samples, see Tables 5-2 and 5-3, respectively.

5.3.6 Comparability

Comparability is a qualitative characteristic that refers to the confidence with which one data set can be compared to another. Comparable data must be obtained using unbiased sample designs. If sampling designs are biased, the reasons for selecting another design should be well documented.

5.4 Data Validation

Laboratory-generated data from the injection well drilling will be validated to Level A. Data validation will be performed in accordance with INEEL Technical Procedure (TPR)-79, "Levels of Analytical Method Data Validation."

The data validation process is intended to support the DQOs listed in Appendix B.

5.5 Quality Assurance/Quality Control Samples

The QA/QC samples will be included to satisfy the QA requirements for the field operation in accordance with the QAPjP (DOE-ID 2000a). Laboratories approved by the SMO will be used for the sample analyses.

Table 5-2. Specific analyte list and sample requirements for the groundwater and rinsate blank non-radiological samples.

Analysis	Analytical Requirements[a]	Sample Medium	Volume/Mass	Container Type[b]	Holding Time	Preservative
CLP (TAL) metals	Table 1-6	Water	1000 mL	HDPE bottle	Analyze within 6 months, except analyze Hg within 28 days[c]	HNO_3 to pH<2[c]
CLP (TAL) volatiles	Table 1-8	Water	2 × 40 mL	40 mL glass vials	Analyze within 14 days[d]	4°C, 4 drops HCl[d]
CLP (TAL) semivolatiles	Table 1-3	Water	1000 mL	Amber glass jugs	Extract within 7 days, analyze extracts within 40 days of extraction[d]	4°C[d]
Anions	Table 1-3	Water	500 mL	HDPE bottle	Analyze within 48 hours for NO_3 and PO_4. All others 28 days[e]	4°C[e]
Pesticides/PCBs	Table 1-4	Water	1000 mL	Amber glass jugs	Extract within 7 days, analyze extracts within 40 days of extraction[f]	4°C
TPH (Method 8015) (gasoline range)	NA	Water	2 × 40 mL	Amber glass, teflon-lined cap	Analyze within 14 days	4°C (add Hcl to pH<2 as necessary)
Cyclohexane		Water	TBD[g]			
Cyclohexanone		Water	TBD[g]			

a The individual compounds and the associated contract required detection limits are identified in the referenced table of the QAPjP (DOE/ID-10587, Rev. 6, Sept. 2000).

b. A certificate of cleanliness will be obtained for all lots of sample containers used.

c. EPA 1993, *Statement of Work Inorganic Analyses-Multi Media, Multi Concentration,* Contract Laboratory Program, ILM 030, June.

d. EPA 1993, *Statement of Work Ogranic Analyses-Multi-Media, Multi Concentration,* Contract Laboratory Program, OLM 01.9, July.

e. EPA 1983, *Methods for the Chemical Analyses of Water and Wastes,* EPA/600/4-79/020, March.

f. EPA 1986, *Test Methods for Evaluating Solid Waste, Physical and Chemical Methods,* Third Edition, SW 486.

g. To be determined in the laboratory TOS.

Table 5-3. Specific analyte list and sample requirements for the groundwater and rinsate blank radiological water analyses.

Analysis	Analytical Requirements[e]	Sample Medium	Approximate Volume[a]	Container Type	Holding Time[c]	Preservative
Alpha Spectrometry	Table 1-7					
Americium (Am-241)		Water	1 L	HDPE[b]	≤ 6 months	HNO_3 to pH <2
Curium Isotopes (Cm-242, 244)		Water	1-2 L	HDPE	≤ 6 months	HNO_3 to pH <2
Neptunium (Np-237)		Water	1 L	HDPE	≤ 6 months	HNO_3 to pH <2
Plutonium Isotopes (Pu-238, 239/240, 242)		Water	1 L	HDPE	≤ 6 months	HNO_3 to pH <2
Thorium Isotopes (Th-228, 230, 232)		Water	1 L	HDPE	≤ 6 months	HNO_3 to pH <2
Uranium Isotopes (U-234, 235, 238)		Water	1 L	HDPE	≤ 6 months	HNO_3 to pH <2
Gamma Spectrometry	Table 1-7	Water	0.5-2 L	HDPE	≤ 6 months	HNO_3 to pH <2
Antimony (Sb-125)						
Cerium (Ce-144)						
Cesium (Cs-134, 137)						
Cobalt (Co-60)						
Europium (Eu-152, 154, 155)						
Manganese (Mn-54)						
Ruthenium (Ru-106)						
Silver (Ag-108m, 110m)						
Zinc (Zn-65)						
Other[e] (Results >2σ <u>and</u> > MDA)[e]						

Table 5-3. (continued).

Analysis	Analytical Requirements[e]	Sample Medium	Approximate Volume[a]	Container Type	Holding Time[c]	Preservative
Specific Analysis	Table 1-7					
Iodine (I-129)[f]		Water	1 L—5 L	Amber-Colored Glass[d]	≤ 6 months	None
Plutonium (Pu-241)		Water	1 L	HDPE	≤ 6 months	HNO_3 to pH <2
Strontium (Sr-90)		Water	0.5—1 L	HDPE	≤ 6 months	HNO_3 to pH <2
Technetium (Tc-99)		Water	0.5—2 L	HDPE	≤ 6 months	HNO_3 to pH <2
Tritium (H-3)		Water	0.1—0.5 L	HDPE	≤ 6 months	None
Indicator Analyses	Table 1-7					
Gross Alpha (gross α)		Water	0.3—1 L	HDPE	≤ 6 months	HNO_3 to pH <2
Gross Beta (gross β)		Water	0.3—1 L	HDPE	≤ 6 months	HNO_3 to pH <2

a. Volumes vary depending on the requested analysis and thelaboratory performing the anlysis (contanct the SMO).

b. HDPE = high-density polyethylene.

c. The holding time requirment of 6 months is described in 40 CFR 136 (EPA guidelines for analysis of pollutants) and is applied in this QAPjP as a general guideline. For analysis of radionuclides with short half-lives (e.g., ^{131}I), the holding times will be adjusted accordingly and disseminated to the laboratory via a project-specific TOS.

d. Collecting samples for I-129 in HDPE containers is permissable/acceptable; however, the holding time requirement is 28 days instead of 6 months.

e. The individual radionuclides and associated contract required detection limit are identified in the referenced table of the QAPjP (DOE/ID-10587, Rev. 6, Sept. 2000).

f. Detection limit requirement for I-129 is 0.1 pCi/L.

6. DOCUMENT MANAGEMENT AND SAMPLE CONTROL

Section 6.1 summarizes document management and sample control. Documentation includes field logbooks used to record field data and sampling procedures, chain-of-custody (COC) forms, and sample container labels. Section 6.2 outlines the sample handling and discusses COC, radioactivity screening, and sample packaging for shipment to the analytical laboratories. The analytical results from this field investigation will be documented in reports and used as input for defining the background conditions in computer models.

6.1 Documentation

The sample FTL will be responsible for controlling and maintaining all field documents and records, and for verifying that all required documents will be submitted to the INEEL ER Administrative Records, and Document Control (ARDC). All entries will be made in indelible black ink. Errors will be corrected by drawing a single line through the error, and entering the correct information. The corrections will be initialed and dated.

6.1.1 Sample Container Labels

Waterproof, gummed labels generated from the SAP database will display information such as the unique sample ID number, the name of the project, sample location, and analysis type. Labels will be completed and placed on the containers in the field before collecting the sample. Information necessary for label completion will include sample date, time, preservative used, field measurements of hazards, and the sampler's initials.

6.1.2 Field Guidance Form

Field guidance forms verifying unique sample numbers provided for each sample location can be generated from the SAP database. These forms contain the following information:

- Media
- Sample ID numbers
- Sample location
- Aliquot ID
- Analysis type
- Container size and type
- Sample preservation.

6.1.3 Field Logbooks

Field logbooks will be used to record information necessary to interpret the analytical data in accordance with ARDC format and controlled and managed according to MCP-231, "Logbooks for ER and D&D&D Projects."

6.1.3.1 Sample Logbooks. The field teams will use sample logbooks. Each sample logbook will contain types of information such as:

- Physical measurements
- All QC samples
- Sample information (sample location, analyses requested for each sample, sample matrix)
- Shipping information (such as collection dates, shipping dates, cooler ID number, destination, COC number, and name of shipper).

6.1.3.2 Sample Field Team Leader's Daily Logbook. A project logbook maintained by the sample FTL will contain a daily summary of the following:

- All field team activities
- Information regarding drilling and sampling locations and depths
- Visitor log
- List of site contacts
- Problems encountered.

This logbook will be signed and dated at the end of each day's sampling activities.

6.1.3.3 Field Instrument Calibration/Standardization Logbook. A logbook containing records of calibration data will be maintained for each piece of equipment requiring periodic calibration or standardization. This logbook will contain logsheets to record the date, time, method of calibration, and instrument ID number.

6.1.3.4 Site Attendance Logbook. A project logbook maintained by the FTL will contain a daily summary of:

- Names of field personnel at the job site
- Company affiliation
- Time of entry and exit of job site.

6.2 Sample Handling

Analytical samples for laboratory analyses will be collected in precleaned, laboratory-certified containers and packaged according to the ASTM or EPA-recommended procedures. The QA samples will be included to satisfy the QA/QC requirements for the field operation as outlined in the QAPjP. Qualified SMO-approved analytical and testing laboratories will analyze the samples.

6.2.1 Sample Preservation

Preservation of soil samples per the SAP and QAPjP will be performed immediately upon sample collection. All soil, rinsate, and QA/QC samples will be placed in coolers containing frozen, reusable ice immediately after sample collection and survey by RADCON. Samples will be maintained at 4°C for preservation immediately after sample collection through sample shipment, as required.

6.2.2 Chain of Custody Procedures

The COC procedures will be followed per MCP-244, "Chain of Custody, Sample Handling, and Packaging," and the QAPjP. Sample containers will be stored in a secured area accessible only to the field team members.

6.2.3 Transportation of Samples

Samples will be shipped in accordance with the regulations issued by the DOT (49 CFR 171 et seq.) and EPA sample handling, packaging, and shipping methods (40 CFR 261.C.3). Samples will be packaged in accordance with the requirements set forth in MCP-244.

6.2.3.1 Custody Seals. Custody seals will be placed on all samples and on shipping containers in such a way as to ensure that tampering or unauthorized opening does not compromise sample integrity. The seals will be signed by the person packaging the samples. Clear, plastic tape will be placed over the seals to ensure that the seals are not damaged during shipment.

6.2.3.2 On-Site and Off-Site Shipping. An on-Site shipment is any transfer of material within the perimeter of the INEEL. Site-specific requirements for transporting samples within INEEL boundaries and those required by the shipping and receiving department will be followed. Shipment within the INEEL boundaries will conform to DOT requirements as stated in 49 CFR 171 et seq. Off-Site sample shipment will be coordinated with INEEL Packaging and Transportation personnel, as necessary, and will conform to all applicable DOT requirements.

6.2.3.3 Nuclear Material Control and Accountability. Historical data indicate that a potential exists for exceeding the minimum reporting quantities specified in PLN-123, "Materials Control and Accountability Plan." Transfers of accountable nuclear material to, from, and within the INEEL must be controlled and monitored. Instructions for shipment and receipts of nuclear materials are provided in MCP-2752, "Shipments and Receipts of Nuclear Material." These instructions will be adhered to through coordination with the appropriate Nuclear Material Custodians and Packaging and Transportation personnel.

6.3 Document Revision Requests

Any revisions to this document will follow MCP-135, "Creating, Modifying, and Canceling Procedures and other DMCS-Controlled Documents, and MCP-230, "Environmental Restoration Document Control Center Interface."

7. REFERENCES

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Appendix A

Sampling and Analysis Plan Tables

Sampling and Analysis Plan Table for Chemical and Radiological Analysis

Plan Table Number: OU3-14 C

SAP Number:

Date: 12/19/2000 Plan Table Revision: 2.0 Project: OU 3-14 RI/FS WORK PLAN - GROUNDWATER Project Manager: FORSYTHE, H. S. SMO Contact: JACKSON, J. D.

Sample Description						Sample Location			
Sampling Activity	Sample Type	Sample Matrix	Coll Type	Sampling Method	Planned Date	Area	Location	Type of Location	Depth (ft)
173001	REG/QC	GROUND WATER	DUP	PUMP	02/01/2001	INTEC	ICPP-MON-A-173	MONITORING WELL	TBD
173002	QC	WATER	FBLK	N/A	02/01/2001	INTEC	QC	FIELD BLANK	N/A
173003	QC	WATER	TBLK	N/A	02/01/2001	INTEC	QC	TRIP BLANK	N/A
173004	QC	WATER	RNST	N/A	02/01/2001	INTEC	QC	EQUIPMNT RINSTE	N/A
174001	REG/QC	GROUND WATER	DUP	PUMP	02/01/2001	INTEC	ICPP-MON-A-174	MONITORING WELL	TBD
174002	QC	WATER	FBLK	N/A	02/01/2001	INTEC	QC	FIELD BLANK	N/A
174003	QC	WATER	TBLK	N/A	02/01/2001	INTEC	QC	TRIP BLANK	N/A
174004	QC	WATER	RNST	N/A	02/01/2001	INTEC	QC	EQUIPMNT RINSTE	N/A

Sampling Activity	Enter Analysis Types (AT) and Quantity Requested																			
	AT1	AT2	AT3	AT4	AT5	AT6	AT7	AT8	AT9	AT10	AT11	AT12	AT13	AT14	AT15	AT16	AT17	AT18	AT19	AT20
	3H	7S	AN	GJ	LA	LL	PB	PC	RH	V9	VA	VE								
173001	1	1	2	1	2	2	1		2			1								
173002					1	1			1		1									
173003											1									
173004	1		1	1	1	1		1	1	1	1									
174001	1	1	2	1	2	2	1		2			1								
174002					1	1			1		1									
174003											1									
174004	1		1	1	1	1		1	1	1	1									

The sampling activity displayed on this table represents the first six characters of the sample identification number. The complete sample identification number (10 characters) will appear on field guidance forms and sample labels.

AT1: CYCLOHEXANE/CYCLOHEXANONE
AT2: SVOCs (TCL) - MS/MSD
AT3: Anions
AT4: VOAs by GC (8015)
AT5: Metals (TAL)
AT6: Metals (TAL) - Filtered
AT7: PCBs - MS/MSD
AT8: PCBs
AT9: Radiochemistry - Suite 1
AT10: SVOCs (TCL)
AT11: VOCs (TCL)
AT12: VOCs (TCL) - MS/MSD
AT13:
AT14:
AT15:
AT16:
AT17:
AT18:
AT19:
AT20:

Comments:
Detection limit for Iodine-129 = 0.1 pCi/L.
Target analyte list (TAL or TCL) for metals, SVOCs, and VOCs will consist of CLP list of analytes, see QAPjP Tables 1-2, 1-3, 1-4, and 1-6. Pyridine shall also be included in the SVOC or VOC list.
AT4 will include methanol and ethyl acetate.
Cm-Iso will include Cm-242 and -244.
Pu-Iso will include Pu-238, and -239/240.
Uranium Isotopic will include U-234, -235, and -238.
Thorium Isotopic will include Th-228, -230, and -232

Analysis Suites:

, Cm-Iso, Am-241, Tc-99, Gross Alpha, Gross Beta, Np-237, Pu-242, Pu-241, Gamma Spec, Pu-Iso, Tritium, Uranium Isotopic, Thorium Isotopic, Sr-90, Iodine-129

Contingencies:

Sampling and Analysis Plan Table for Chemical and Radiological Analysis

Plan Table Number: OU3-14 B

SAP Number: DOE/ID-10763

Date: 12/19/2000 Plan Table Revision: 1.0 Project: OU 3-14 RI/FS WORK PLAN - INJECTION WELLS Project Manager: FORSYTHE, H. S. SMO Contact: JACKSON, J. D.

Sample Description						Sample Location				Enter Analysis Types (AT) and Quantity Requested																			
Sampling Activity	Sample Type	Sample Matrix	Coll Type	Sampling Method	Planned Date	Area	Location	Type of Location	Depth (ft)	AT1 3H	AT2 AN	AT3 GJ	AT4 LA	AT5 PC	AT6 RN	AT7 V9	AT8 VA	AT9	AT10	AT11	AT12	AT13	AT14	AT15	AT16	AT17	AT18	AT19	AT20
IW3001	REG	SEDIMENT	CORE	DISCR	02/01/2001	CPP-23	CPP-03	INJECTION WELL	450-460	1	1	1	1	1	1	1	1												
IW3002	REG	SEDIMENT	CORE	DISCR	02/01/2001	CPP-23	CPP-03	INJECTION WELL	480-490	1	1	1	1	1	1	1	1												
IW3003	REG	SEDIMENT	CORE	DISCR	02/01/2001	CPP-23	CPP-03	INJECTION WELL	510-520	1	1	1	1	1	1	1	1												
IW3004	REG/QC	SEDIMENT	DUP	DISCR	02/01/2001	CPP-23	CPP-03	INJECTION WELL	540-550	2	2	2	2	2	2	2	2												
IW3005	REG	SEDIMENT	CORE	DISCR	02/01/2001	CPP-23	CPP-03	INJECTION WELL	570-580	1	1	1	1	1	1	1	1												
IW3006	REG	SEDIMENT	CORE	DISCR	02/01/2001	CPP-23	CPP-03	INJECTION WELL	600-610	1	1	1	1	1	1	1	1												
IW3007	REG	SEDIMENT	CORE	DISCR	02/01/2001	CPP-23	CPP-03	INJECTION WELL	630-BOTTM	1	1	1	1	1	1	1	1												
IW3008	QC	WATER	FBLK	N/A	02/01/2001	CPP-23	QC	FIELD BLANK	N/A						1														
IW3009	QC	WATER	RNST	N/A	02/01/2001	CPP-23	QC	EQUIPMNT RINSTE	N/A	1	1	1	1	1	1	1	1												

The sampling activity displayed on this table represents the first six characters of the sample identification number. The complete sample identification number (10 characters) will appear on field guidance forms and sample labels.

AT1: CYCLOHEXANE/CYCLOHEXANONE
AT2: Anions
AT3: VOAs by GC (8015)
AT4: Metals (TAL)
AT5: PCBs
AT6: Radionuclides - Suite 2
AT7: SVOCs (TCL)
AT8: VOCs (TCL)
AT9:
AT10:

AT11:
AT12:
AT13:
AT14:
AT15:
AT16:
AT17:
AT18:
AT19:
AT20:

Comments:

Target analyte list (TAL or TCL) for metals, SVOCs, and VOCs will consist of CLP list of analytes, see QAPjP Tables 1-2, 1-3, 1-4, and 1-6. Pyridine shall also be included in the SVOC or VOC list.
AT3 will include methanol and ethyl acetate.
Cm-Iso will include Cm-242 and -244.
Pu-Iso will include Pu-238, and -239/240.
Uranium Isotopic will include U-234, -235, and -238.
Thorium Isotopic will include Th-228, -230, and -232

Analysis Suites:

Radionuclides - Suite 2 includes: Cm-Iso, Am-241, Tc-99, Gross Alpha, Gross Beta, Np-237, Pu-242, Pu-241, Gamma Spec, Pu-Iso, Tritium, Uranium Isotopic, Thorium Isotopic, Sr-90, Iodine-129

Contingencies:

Appendix B

Data Quality Objectives

Table B-1. OU 3-14 injection well (Site CPP-23) DQOs.

1: State the Problem	2: Identify the Decision			3: Identify Inputs to the Decision	4: Define the Study Boundaries
	Success at meeting the remedial action objective will be determined by obtaining sufficient characterization data to develop a RI/FS, proposed plan, and ROD from which a remedial action can be implemented that will prevent contaminants associated with the injection well (CPP-3) from adversely impacting the SRPA under INTEC.				
	Principal Study Questions	Alternative Actions	Decision Statement		
Background Statement: The former injection well, CPP-3, also known as Site CPP-23 was the primary source for liquid waste disposal from 1952 through February 1984 and used intermittently for emergency situations until 1986. The average discharge to the well during this period was approximately 1.4 B L/yr (363 M gal/year) or about 3.8 M L/day (1 M gal/day) (DOE-ID 1997b). It has been estimated that a total of 22,000 Ci of radioactive contaminants have been released in 4.2×10^{10} L (1.1×10^{10} gal) of water (WINCO 1994). The majority of the radioactivity is attributed to H-3 (approximately 96% of the total curies). The Track 2 Summary Report for CPP-23 Injection Well (1994), Comprehensive RI/FS for OU 3-13 at the INEEL – Part A, RI/BRA Report (DOE-ID 1997) and the OU 3-13 Record of Decision (DOE-ID 1999) identified several contaminants that may have been discharged to the injection well. Based on these reports, the contaminants of potential concern (COPCs) for the injection well include I-129, Sr-90, Pu-isotopes, H-3, Am-241, TC-00, Cs-137, Co-60, Eu-152/-154, arsenic, chromium, mercury, nitrate/nitrite, and osmium. In addition, the injection well has completed RCRA closures as described in the Final Closure Plan for LDU CPP-23 Injection Well (MAH-FE-PL-304) (DOE-ID 1990). In Section 2.1 of this closure plan, it states that "The only known contaminant release to the well identified as a RCRA concern is the mercury release which occurred in March 1981." As part of the closure effect, a sediment sample was collected from the injection well by the USGS on August 31, 1989 and analyzed for 40 CFR 261 Appendix VIII hazardous constituents, for which EPA-approved methods exist. Analyses of the sediment sample detected traces of metals, radioactivity, and PCBs. No organic compounds, other that PCBs, were detected in the sediment sample form the injection well. The closure plan also required the collections and Appendix VIII analysis of groundwater samples from the adjacent well (USGS-40 and USGS-47) and the production well (Production Well #1). The results also did not detect organic compounds in the groundwater. Based upon these results, it appears that the COPCs for the injection well consist of radionuclides, metals, and PCBs. For completeness and to address possible uncertainities, the sediments from the injection well will also be sampled for the nine listed waste constituents previously identified at INTEC (benzene, carbon disulfide, carbon tetrachloride, hydrogen fluoride, pyridine, tetrachloroethylene, toluene, 1,1,1-trichloroethane, and trichloroethylene). In addition, the following constituents (acetone, cyclohexane, cyclohexanone, ethyl acetate, methanol, methyl isobutyl, keton, and xylene) were identified to present in INEEL waste streams (INEEL/EXT-98-01212, revision 1, February 1999) and will be sampled. The well was initially drilled in 1950 to a depth of 65 m (212 ft) bgs and abandoned. In 1952 the borehole was cleaned out and deepened to a depth of 182 m (598 ft) bgs. The 61 cm (24-in.) diameter hole was cased with 0.8 cm (5/16-in.) carbon steel casing and perforated from 149 to 180 m (489 to 592 ft) bgs. A second set of perforations, above the water table and spanning 126 to 138 m (412 to 452) bgs, was added after well development to "provide air outlets". The well had a total of 1.5 m^2 (16 ft^2) of perforations below the water table and 0.5 m^2 (6 ft^2) above the water table. The "injection effect" of CPP-3 created high ground water velocities immediately around the release point, as much as 1,524 m (5,000 ft) per day. This effect became insignificant at distances greater than 305 m (1,000 ft) from the disposal well. Water initially moved radially out around the well for some distance, overriding the regional flow direction. Wastewater may have been injected at several depths depending on the well perforations. There are two intervals of casing disintegration (1967 or 1968 and 1981) and repair (1971 and 1982). During periods when the injection well was plugged, the waste were discharged directly into the vadose zone resulting in a thick zone of contamination underlying INTEC. This zone may serve as a possible source of contamination to the deep perched water zone and complicates any interpretation of contamination in the subsurface. During repair periods, the waste were also injected into USGS-50, a well completed at 123 m (405 ft) bgs. In October and November 1989, the injection well was sealed by perforating the casing throughout and pumping in cement. The well was sealed from the basalt silt layer (145m [475 ft] bgs) to land surface to prevent hydraulic communication between the land surface, perched water, and SRPA. Before the well abandonment, a sediment sample was collected from the bottom of the open part of the well (about 145 m [475 ft] bgs). Analysis of the sediment sample detected low concentrations of inorganics, radionuclides, and polychlorinated biphenyls (PCBs). Fourteen inorganics were detected. The concentration of barium (0.26 mg/L) was well below the regulatory threshold of 100 mg/L. The radionculide analyses of the sediments show that the gross beta activity was measured at 150 pCi/g. This analysis also measured Cs-137 at 100 pCi/g, Eu-152 at 3.8 pCi/g, and Eu-154 at 2.5 pCi/g. The only organic compound detected above the method detection limit was Aroclor-1260 at 10 $\mu g/kg$ (DOE-ID 1997a). Due to the uncertainty associated with the contaminant source estimates and potential releases from the soil and perched water around the injection well, the final remedial action for the SRPA inside the INTEC fence line is part of the OU 3-14 scope and will be included in the OU3-14 RI/FS, project plan, and ROD. **Problem Statement**: The potential problem involving the SRPA is two-fold. First, the injection well is known to have injected contaminated fluids into the SRPA a 36.6-m (120-ft) sediment column has built-up inside the casing volume of residual contamination is not well characterized, as are the specific contaminants, their amounts, concentrations, and mobility. Second, there is uncertainty resulting from contaminant source estimates and potential releases from the vadose zone in the vicinity of the injection well.	PSQ-1: Are there any unresolved issues pertaining to the Aquifer quality from the OU 3-13 Group 5 interim action and Group 4 final action? (More information may be obtained by consulting the OU 3-13 ROD [DOE-ID 1999b]).	A: There are no issues. Proceed. (No consequence.) B: There are issues. Resolve the issues. (Consequences are that additional principal study questions may be added and additional data other than what is listed below may be required. This may have impact on both the schedule and budget.)	DS-1: Determine whether there are unresolved issues from the OU 3-13 Groups 4 and 5 final and interim actions.	Inputs to the PSQ-1 decision include: OU 3-13 Group 5 interim action information OU 3-13 Group 4 final action information	This study focuses on sufficiently characterizing the injection well (Site CPP-23) to understand the contamination types, levels, distribution, and source term; the risks associated with the contamination; and the hydrology and geochemistry for the purpose of identifying effective remedial actions for the WAG 3 OU3-14 RI/FS, proposed plan, and ROD. The physical boundaries of the investigation include Site CPP-23 from the ground surface down to and including the SRPA. The SRPA under the entire INTEC is included in the physical boundary of this investigation. Additional boundaries that could possibly impact the project include: *Schedule boundaries:* The schedule may be impacted by the budget allotted for the remedial action. Any loss in the budget without adjustment in scope will extend the schedule. That action may adversely impact the mitigation of the transport of contaminants to the SRPA. *Budget boundaries:* The budget is anticipated to remain at a constant funding level during the course of the investigation. This will require that remedial actions be optimized not only technically but also financially. *Concentration boundaries:* These boundaries result from contaminant concentrations. For radionuclide concentrations the boundaries extend from low concentrations to the risk-based action levels agreed to in the OU 3-13 ROD. A high dose rate could drive remote remedial methods. Other remedial considerations related to concentration levels include upper inventory levels of possible waste disposal facilities. Metals concentration levels should not impact remedial activities. Should high VOC levels be present, some remedial activities could be affected, e.g., grout and thermal processes. *Operational boundaries:* The investigation of the Injection Well could be impacted by ongoing INTEC operations. *Treatment evaluation boundaries:* The evaluation of remedial technologies may potentially be impacted by a variety of laboratory-related influences including scale, contamination levels, and heterogeneity. It may also be impacted by the implementability of the treatment. *Integration boundaries:* Final remediation may be impacted by the integration of any or all of the above boundaries.
	PSQ-2a: What are the residual contaminants and their concentrations in the sediment inside CPP-3 and in SRPA materials near the well (Site CPP-23)? This analysis includes radionuclides as well as non-radionuclide contaminants.	A: Analytical results indicate the sediment is free of residual contamination that might pose a risk to the SRPA. Proceed with RI/FS characterization. (No consequence is associated with this alternative.) B: Analytical results of the sample cores collected from the wells indicate that there are contaminants present in the material that could potentially be a risk to the SRPA. Determine waste types, volumes, secondary source potential, etc. (The consequence is that the contamination will require remediation.)	DS-2a: Determine whether the sampling and analytical results have successfully identified all contaminants in the sediment in and near CPP-3.	Inputs to the PSQ-2a decision include: Core analytical data (rad and non rad) USGS downhole geophysical logging Historical records Process knowledge and risk analysis	
	PSQ-2b What is the vertical and horizontal extent of the contaminants in the sediment inside the injection well and contaminated aquifer materials near the injection well?	A: Sufficient data exist to determine the contaminant stratification in the sediment and in the contaminated SRPA materials near the injection well to evaluate risk and determine volume concentrations. Proceed with the RI/FS characterization. (No consequence is associated with this alternative.) B: Additional data are needed to characterize contaminants in the sediment in the injection well and in the sediments near the injection well. Collect additional data. (The consequence is that additional data will be required to assess risk and determine effective remedial techniques, should they be necessary.)	DS-2b: Determine whether radionuclide and non-radionuclide contaminants in the sediment inside the injection well and in SRPA materials near the injection are sufficiently characterized to evaluate risk, contaminants, and propose effective remedial actions, if required.	Inputs to the PSQ-2b decision include: Historical records Process knowledge Analytical data (rad and non rad) Risk analysis Model predictions K_d data Hydraulic property data	
	PSQ-2c: If contaminants are present above risk action levels in the sediment and contaminated aquifer materials near the injection well, can they be mobilized and released to the SRPA as a secondary source?	A: Contaminants are strongly sorbed to the sediment and contaminated sediments near the Injection well. Proceed with characterization. (No consequence is associated with this alternative.) B: Contaminants are mobile and are being or potentially can be leached out of the sediment and contaminated SRPA materials. This has implications for possible remedial actions as well as risk considerations. Evaluate need for Stage II actions. Proceed with characterization. (The final remedial action will be required to minimize contaminant mobility either by removing the contaminants and/or immobilizing them.)	DS-2c: Determine whether contaminants are easily released from the soil and sediment. If so, remedial actions such as sediment and contaminated sediments removal, for example, may be required. High mobility also increases the opportunity for leaching to occur and contaminants becoming a secondary source.	Inputs to the PSQ-2c decision include: Analytical concentration data (rad and non rad) Selected soil extractions K_d data Model predictions Hydraulic properties Risk analysis	
	PSQ-3: What are the residual contaminant concentrations in the Aquifer near Site CPP-23 of radionuclides and non-radionuclides?	A: The radionuclides identified as OU 3-13 COPCs are the only contaminants that are potential threats to the SRPA. Proceed with characterization. (The consequence is that the remedial action will be required to address all known compounds that fulfill OU 3-14 COPC criteria.) B: Other contaminants, in addition to the OU 3-13 COPCs, are present above risk based action levels and could potentially pose a threat to the SRPA. (The consequence is that the remedial action will be required to address all OU 3-14 COPCs.)	DS-3: Determine whether analytical results and/or risk analysis identifies contaminants in the SPRA water at concentration levels equal to or greater than MCLs.	Inputs to the PSQ-3 decision include Historical records SRPA analytical data Risk analysis results Model predictions K_d data Hydraulic properties OU 3-13 Group 5 interim action data OU 3-13 Group 4 final action data	
	PSQ-4: Do localized hot spots (e.g., iodine-129 at the HI interbed) exceed risk-based action levels in the SRPA?	A.: Hot spots do not exist. (The consequence is that additional modeling will be required.).	DS-4: Determine whether hot spots exist in the SRPA with the potential to exceed action levels.	Inputs to the PSQ-4 include Historical records Core analytical data Pore water analytical data Field screening data Risk analysis results K_d data Model predictions Hydraulic properties OU 3-13 Group 5 interim action data	

		B: Hot spots exist, e.g., I-129 is found in the HI interbed at levels that exceed risk based action levels. Collect more information on hot spots. Rerun the SRPA model. (The consequence requires a remedial action to remove or control the contaminant.)			
	PSQ-5 Based upon new data obtained during the evaluation of the injection well, sediment in the well, and contaminated aquifer materials near the well, will remedial action be required and what are the best remedial approaches?	A: There is enough data to characterize risk and the possible contaminants associated with the former injection well and Tank Farm soil to write a RI/FS, ROD, and develop appropriate remedial alternatives. (No consequence.)	DS-5: The recommended remedial action will be based on the hydraulic, geochemical, and physical drivers; the success of the interim actions; and the comparison of identified requirements, associated technology, and their costs.	Inputs to the PSQ-5 decision include: Final OU 3-14 injection well (Site CPP-23) COPC list Concentration levels (water, sediments) Contaminant mobility Secondary source information OU 3-13 Group 4 and 5 data Hydraulic properties K_d data Model predictions Waste types Remedial cost Practicability, feasibility, and maturity technology	
		B: There is still too much uncertainty to develop an RI/FS, ROD, or suggest appropriate remedial actions. (The consequence is that more data will be required.)			

5: Develop a Decision Rule	6: Specify Tolerable Limits on Decision Errors	7: Optimize the Design
DS-1: If there are no unresolved issues from OU 3-13 Group 4 and 5, then proceed with Alternative A, otherwise proceed with Alternative B.	Data collected to determine whether contaminants in the SRPA water are at concentration levels equal to or greater than MCLs (DS-3) are amenable to statistically based limits on decision errors. Hypothesis testing will be utilized to determine if an action level (MCL) is exceeded to resolve Principal Study Question 3 (PSQ-3).	A total of 3 wells will be drilled to the approximate depth of 198 m (650 ft) below ground surface (bgs). One of the wells will be placed directly inside the former injection well. A second well will be drilled as close to the former injection well as possible. Both of these wells will be cored to permit the collection of sediments, basalts, and injection well sediment. The vadose zone cores from the well adjacent to the INTEC injection well will be handled and archived for possible future analysis by OU 3-14. Samples will be analyzed for the analytes of concern identified in the injection well field sampling plan. If analytical results indicate contaminant concentrations are not above MCLs or risk based action levels (for any of the contaminants), the RI/BRA will be completed. If concentrations are above MCLs, an RI/FS that includes leachability studies may be performed. The second well will be completed as a monitoring well.
DS-2a: If there are no residual contamination in the sediment or contaminated SRPA materials, then proceed with Alternative A, otherwise proceed with Alternative B.	The null hypothesis, H_0, is that the true mean of a contaminant is greater than or equal to the MCL. The alternative is that the true mean is less than the MCL.	The third well will be located about 91.4 m (300 ft) down gradient from the former injection well. This well will also be cored and samples collected for possible future analyses. This well will be completed as a monitoring well and screened with a 15.2 m (50-ft) screen across the HI interbed.
DS-2b: If there is sufficient data to determine contaminant stratification in the sediment, then proceed with Alternative A, otherwise proceed with Alternative B.	H_0: $\mu \geq$ MCL0 H_a: $\mu <$ MCL	The two monitoring wells will be sampled quarterly for to develop the final OU 3-14 COPC list.
DS-2c: If contaminants are strongly sorbed to the sediment and/or contaminated SRPA materials, then proceed with Alternative A, otherwise proceed with Alternative B.	The hypothesis testing will be performed to a level of significance, α, of 0.05. In other words, with this level of significance, we limit the probability of a Type I error, or of rejecting the null hypothesis when it is true, to 5%. The hypothesis testing is designed to allow us to control the probability or erroneously concluding that MCLs are not exceeded when in fact they are exceeded. The null hypothesis was formulated based upon the belief that the harmful consequences of incorrectly concluding that a MCL is not exceeded when it actually is exceeded outweigh the consequences of incorrectly concluding that the MCL is exceeded when in fact it is not.	
DS-3: If OU 3-13 COPCs specified in the OU 3-13 RODs are the only contaminants that exceed risk based action levels, then proceed with Alternative A, otherwise proceed with Alternative B.		
DS-4: If "hot spots" do not exist, then proceed with Alternative A, otherwise proceed with Alternative B.	Statistically based decision errors are not appropriate for the other decision statements.	
DS-5: If sufficient data to characterize the risk and the contaminants associated with the former injection well to write a RI/FS, ROD, and develop appropriate remedial actions exist, then proceed with Alternative A, otherwise proceed with Alternative B.	Add new information under 4.4.2.8.	

Appendix C

Explanation of ICPP-MON-A-174 Location

Appendix C

Location of Groundwater Monitoring Well (ICPP-MON-A-174) at the Idaho Nuclear Technology and Engineering Center (INTEC)

Monitoring well ICPP-MON-A-174 will be located approximately 91 m (300 ft) downgradient of the INTEC injection well (MAH-FE-PL-304) at the south-central portion of a concrete slab situated due east of Building CPP-617. The well shall be located at an azimuth of 205 degrees from the injection well as determined using inferred groundwater flow directions in the area.

The well will be located on the concrete slab in order to avoid logistical difficulties in siting the well at another location. The groundwater flow direction beneath INTEC is expected to be to the SSW at approximately 205 degrees. The longitudinal axis of an observed I-129 plume at INTEC was observed to be oriented at approximately 205 degrees during two measurement periods in 1986 and 1990-1991.[1] The 205-degree flow direction in the vicinity of INTEC is further corroborated by geometric hydraulic gradient analyses performed by Rohe.[2] Operable Unit 3-14 data quality objectives that were generated for the injection well monitoring effort recommend that the monitoring well be located approximately 91 m (300 ft) downgradient of MAH-FE-PL-304. However, physical infrastructure at INTEC limits the feasibility of selecting other potential downgradient well locations and limits the monitoring well site to the concrete slab.

Groundwater flow velocities exceeding 610 m/yr (2,000 ft/yr) could be expected at the INEEL based on maximum estimates of hydraulic conductivity for Eastern Snake River Plain basalts. Weakly to moderately retarded solutes would be expected to migrate at least 6.1 m (20 ft) downgradient (i.e., to the monitoring well) each year if the maximum groundwater velocity estimate is valid. Site-specific hydraulic data are unavailable to more adequately refine an estimate of groundwater flow velocity; therefore, the conservative maximum value is assumed during sighting of well ICPP-MON-A-174.

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[1] Mann, L. J. and T. M. Beasley, 1994, *Iodine-129 in the Snake River Plain Aquifer at and Near the Idaho National Engineering Laboratory, Idaho, 1990–1991*, Water-Resources Investigations Report 94-4053, U.S. Geological Survey.

[2] Rohe, M. J., 2000, *Application of a Geometric Technique for Determining Aquifer Hydraulic Gradient from Water Level Data*, INEEL External Report (Draft), Idaho National Engineering and Environmental Laboratory, June.